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Read Ocean Tests Materials

# HEMISTRY

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Editorial:

Outwitting Nature

Inside Front Cover

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## *Outwitting Nature*

► THE HIGHLY ionized salt solution that splashes the shores of our continents is a mighty force for dissolving materials of all kinds, especially metal. Navies and merchant ships must keep men constantly polishing brass and painting iron as protection against the sea's devouring action. It would be convenient to find a material even more resistant to corrosion than copper and its alloys, or to change the properties of seawater, to make its dissolving power less active.

Many chemists have tried to pit their skill against the sea in the battle against corrosion, and several kinds of solutions to the problem have been brought into use lately. A modification of a process used on land is even being tried at sea, with the aim of modifying, within a small space around the test plate, the action of the sea itself. Relying on the electrolytic principle that traces corrosion to pairs of unlike materials acting like tiny battery plates, many land installations, such as pipes and conduits, are protected by strips of metal buried nearby. The protective strip is of metal chosen to go into solution by action of small ground currents, to save the more important metals of the pipes which carry electric wires or water.

The idea of applying electrolytic protection to metals exposed to action of salt spray is certainly practical, even if the thought of modifying the salt concentration of the ocean itself seems like an ambitious project. Both zinc and magnesium are good protective metals. In the use of magnesium we find an interesting cycle. We use electricity to get magnesium from the sea, so that we may put it back into sea water to protect other metals from action of electricity.

Paint is essentially a layer of metallic oxide. The metal beneath is protected by material which has already been corroded into a stable form. The secret of the stability of some metals, including aluminum and titanium, is their power to form a coating of oxide at the surface which does not flake off as iron rust does. Among non-corroding metals, none looks more promising than titanium. It is light, strong and plentiful. All that is needed is a cheap way to get it out of combination.

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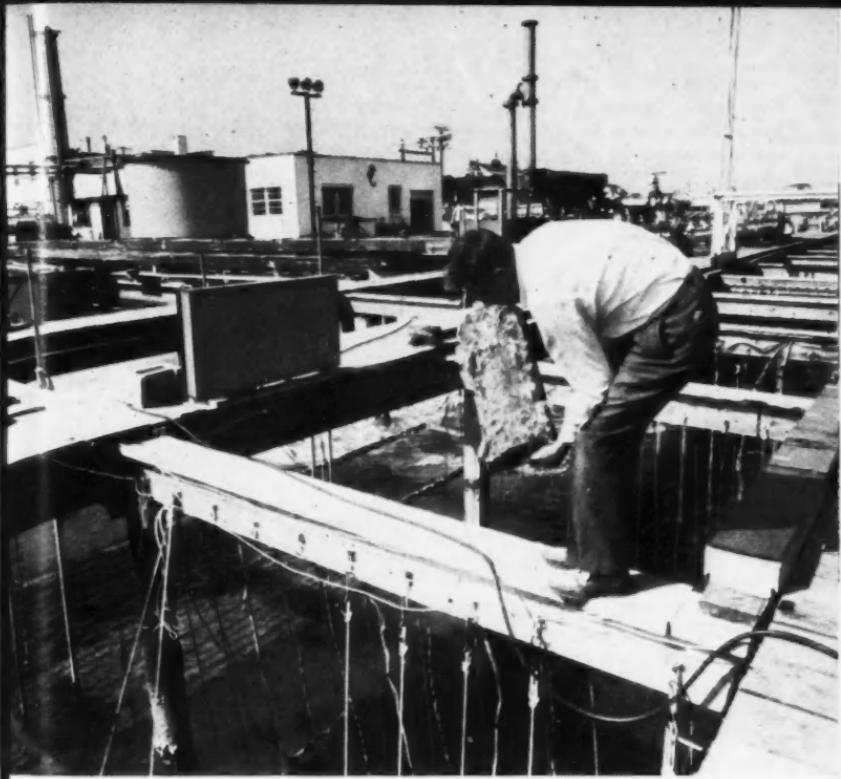
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*Editors:* WATSON DAVIS and HELEN MILES DAVIS

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► SPECIMEN ENCRUSTED with marine life is pulled from the ocean test tube at Kure Beach where materials are tested for their endurance in the sea. The testing building contains complicated apparatus to study many kinds of material under strenuous conditions. The ocean-covered racks from which H. T. Patterson, Jr., has taken the sample contain thousands of materials which are being tested.

## Ocean Tests Materials

by FREMONT DAVIS

► THE DIGESTION of King Neptune and the sting of his breath are being determined with scientific accuracy in a gigantic ocean test tube at Kure Beach, N. C. At this beach on an inlet near Wilmington, N. C., scientists find

plenty of uncontaminated sea water with a wide range of temperature and a long period of growth for marine life. Here metals may be destroyed by the sea just as they would be in normal sea construction. Wood will be

eaten by the variety of borers that will attack it should it be used as piles or in ships unless it is protected. The elements and Neptune also can be used here to test plastics and rope and a variety of antifouling materials, fastenings and bonding substances.

A real test, under the conditions that the material will have to stand, is set for the samples that are studied here. The tides and the storms add their destruction to the tests, but the scientists must stand a long vigil to tend the specimens, some of which are observed for periods of 12 years. In the museum that is a part of this station some surprises are in store. Samples of wood are there. Hard oak, soft balsa and the conifers such as pine, redwood, cypress and others form one group on the shelf. King Neptune's borers and marine life found the oak more palatable than the soft redwood.

Fifteen hundred scientists representing 200 co-operating companies have visited the beach. Army and Navy representatives have been there often. An auditorium is provided so that groups of scientists can gather and discuss the results of these tests, which sometimes carry more complicated surprises that can be quite costly.

Costly surprises must be avoided. The ability of ships to operate with steam turbines requires that the condenser tubes function efficiently. Failure of condenser tubes by corrosion can put the ship out of commission. This did happen disastrously in the British Navy during the First World War and led to research on better condenser tube materials. This work continues as a major activity at the Kure Beach Project. The copper nickel alloys developed in these research pro-

grams are now the standard materials in both the British and United States Navies. They are noted for their reliability for this service.

The erosive effects of sea water as encountered in condensers and pipelines can be simulated by exposing metals to the action of jets of sea water mixed with air. Apparatus of this type is being used to find condenser tube alloys that are better able to stand up to this impingement attack.

As is the case with corrosion in other media, sea water corrosion involves the flow of electrical currents. These currents destroy the metal where they leave to enter the water, but protect it where they enter the metal.

This effect is demonstrated by large steel plates on the end of the pier at Kure Beach. They extend from above high tide to below low tide. When the tide is high, current flows from the steel below low-tide level to the steel in the tidal zone. This reduces corrosion in the tidal zone. The same principle can be applied to provide similar protection to the whole of the immersed steel surfaces by the controlled application of protective current from some external source of electricity.

This is the means used to protect the steel structures in oil drilling platforms in the Gulf of Mexico. The laid-up merchant fleet and naval vessels are protected this way.

The International Nickel Company which established and runs this test station decided to make this new home itself a test project. By using its own products and those of the co-operating companies, it was able to make many actual tests of materials by incorpor-



► CORDAGE is tested at Kure Beach to determine the length of its life at sea.

ating them in the buildings and parts of the plant. The roof is of monel metal. The fence is in two parts, one part stainless steel, the other galvanized steel.

Piles in the pier are full-sized test pieces. They are timber pieces treated with preservatives of various sorts to prevent destruction by marine borers. Some are of steel with various protective coatings. These range from modern organic coatings to coatings of hot sprayed or dipped metals. Some are sheathed with monel or cupro-nickel coverings. Some are protected by the currents set up by contact with magnesium immersed near them. The wearing quality of the materials from which the station is made will help scientists and manufacturers choose the right material to build things that must stand the ravages of the sea.

Simply to hang test pieces over the side is not enough to test the destructiveness of Neptune's digestion. The sea bites off chunks of materials faster when it moves against them in a stream. Six hundred feet of trough are available to test pieces for resistance to sea water flowing at a moderate speed.

New information on the effect of the electric currents within the metal is being found. Special apparatus is used to unravel the intricacies of the electrochemical behavior of metals in sea water and to provide new fundamental information on which the more effective control of sea water corrosion may be based.

Pieces of machinery that must stand sea water usage at high velocity can be given a whirling test on spindles rotating at high speeds. Protective

films sometimes come off at such speeds. The propeller or the pump or the ship bottom would then be left dangerously unprotected.

The facilities of this test station were used to explore the unusual ability of titanium to resist attack by sea water and sea air under all conditions of exposure. In this respect titanium has performed as well as some of the older complex nickel-molybdenum-chromium alloys and should find many applications when production has increased and its price has been lowered. Because titanium is about one-half the weight of iron and is strong, it would be useful where a light, strong and resistant metal is needed.

Some examples of the use of test data for the selection of materials for particular purposes are:

For pump impellers to resist erosion at high velocity, monel and stainless steels.

For propeller shafts on PT boats, K-monel.

For screws in wood, monel.

For sheathing in wooden boats, 70:30 copper nickel.

For salt water pipe lines, 70:30 and 90:10 copper, nickel.

For antifouling paints, cuprous oxide in a vinyl vehicle.

For wooden piling preservative, creosote.

For natural woodpiling without a preservative, greenheart timber from South America.

For cordage underwater, nylon or saran.

For cordage above water, treated manila.

For anodes to protect other metals, magnesium and high purity zinc.

King Neptune's breath has a wearing effect on metals and materials. On sloping racks about 800 feet from the shore over 20,000 specimens have been exposed and evaluated. They lose weight, change in their mechanical properties and you can see the change that has occurred.

A more ruthless test is used on a large group of specimens. About 1500 have been exposed to the air and the sea spray only 80 feet from the surf. Some of these have corroded 10 times as fast as the ones 800 feet from the surf.

Data from this testing project indicate the selection of these materials for particular purposes:

As a metallic coating for steel in a salt atmosphere, aluminum, cadmium and zinc applied by dipping, plating or spraying can be used.

As a decorative coating for steel in a salt atmosphere, chromium over nickel plating can be used.

As an organic coating for steel in a salt atmosphere, vinyl paint over sandblasted steel or coal tar enamel is satisfactory.

The actual working pieces of apparatus are often tested at Kure Beach. There is a pipe-line there that would be a headache for any plumber. The sea is pumped through it at high speed and there is not a straight piece of pipe in it. It is designed to test joints, bends, and valves for their sea-water-worthiness. The apparatus resembles a huge complicated maze.

Units for making fresh water out of salt water are under test. Tests are easier at the station because the con-

tions can be controlled more readily than on ship board. Pieces of apparatus for the navy are tested in model size and in full size.

New materials as they are developed will be showing their worthiness to

the scientists who evaluate them at Kure Beach. Studies of the behavior of materials will give the metallurgist and the research scientist clues to new ways to make materials more enduring.

## On the Back Cover

► DEPTH of immersion is studied to compare corrosion effects below the surface of the sea on submerged plates with damage to plates buffeted by waves at International Nickel Co.'s testing station at Kure Beach, N. C.

## Boron in Steel Saves Alloying Metals

► "CAPSULES" of boron, a metal in plentiful supply in the United States, are enabling steelmakers to conserve vast amounts of critically scarce alloying metals.

Found in boric acid and borax, boron is added in very small quantities to replace chromium, nickel and molybdenum, which improve the hardenability of steel. It is being used in about 70,000 tons of steel per month to save large quantities of those vitally important alloying metals.

The Korean war, which created a greater demand for military products made of alloy steels, has stimulated the use of boron by steelmakers squeezed in the alloy shortage, *Steelways*, the magazine of the American Iron and Steel Institute, reports. A wheelbarrow load of boron dumped

into a heat of steel may save almost two and one-half tons of nickel, about three-quarters of a ton of chromium and nearly one-third of a ton of molybdenum.

The possibility of using boron to improve the physical quality of steel was first suggested in the 1890's. But it was not until the late 1930's, when an alloy shortage loomed, that investigation of boron was undertaken on a large scale.

Today, boron steels have been pretty well proved. If they receive the kind of scientific handling steel should get in manufacturing plants, they often give longer and better service than the steels they replace. And because they save alloying metals, they are certainly cheaper, which bodes well for their use after the emergency is over.

## New Method for Making Important Chemical

# Hydrazine Source of T.B. Drug

► A NEW METHOD for making hydrazine, the chemical source of rocket fuel and the TB drug isoniazid, was announced by three chemists of the University of Utah at the American Chemical Society's recent national meeting.

Hydrazine can be prepared on a commercial scale by shooting high-frequency electric current through ammonia gas, according to Professor Bruno J. Zwolinski, who presented the report. Co-authors of the paper were W. Hoyt Andersen and Professor Ransom B. Parlin.

The new process should help to supply the increasing demand for hydrazine, Professor Zwolinski indicated. Improved engineering practices may also result in lowering the cost of the chemical.

Ammonia also is used in the older method of making the colorless, fuming liquid, it was pointed out. In this process, however, ammonia is converted into hydrazine by chemical means, rather than by an electrical discharge.

Chemically-made hydrazine contains water, which must be removed. Since dehydration of the water-containing hydrazine is expensive and difficult, the chemists sought a way of making a water-free product. Their research led them to the new electrical discharge method.

Although hydrazine has been known and studied for many years, it is only

recently that its chemical usefulness has affected the lives of people. Prior to World War II hydrazine was used chiefly in the form of its derivatives, but during this war the Germans discovered that hydrazine itself had very desirable properties as a jet and rocket fuel. Since that period increasing interest in hydrazine has arisen, and a large number of unexplored uses for it have now appeared.

The present investigation was undertaken to establish the physical conditions of the discharge under which yields of hydrazine from ammonia are greatest, and to attempt to clarify the nature of the chemical reactions taking place in the discharge. A high frequency rather than a DC discharge was employed in order to reduce thermal effects to a minimum, since the stability of hydrazine is very dependent on temperature.

It was found that high flow rates of gas through the discharge tube, small discharge currents, low pressures and small electrode gap distances are most effective for producing highest hydrazine yields per unit of energy dissipated in the discharge tube. Under these conditions maximum concentrations of the species which produce hydrazine are formed, and the produced hydrazine is swept away from the discharge before it is destroyed. The maximum yields under the conditions employed were from 4 to 6 grams of hydrazine produced per kilo-

watt-hour of energy dissipated in the discharge tube. These numbers could be increased to some extent if all conditions were at an optimum.

The investigation disclosed that ammonia molecules are very sensitive toward electron impact. In order that high hydrazine yields can be realized, carefully controlled electron-induced dissociations of ammonia must be brought about to minimize the production of hydrogen and nitrogen which normally occurs for large values of electron energies. In addition the time the ammonia molecules spend in the discharge must be very short and hence the flow rate must be high.

The commercial preparation of hydrazine from ammonia by electric discharge appears feasible from an economic point of view if the cost of hydrazine continues high, and if good engineering practices are established in its production. This latter problem is by no means small. The energy yields quoted are based on power input to the discharge tube and not on the total power required for the operation of the transmitter. A recycling process not employed in these studies could probably be employed industrially, resulting in lower cost yields of hydrazine.

One of the products made from hydrazine is the drug isoniazid, used in treating tuberculosis. Isoniazid's chemical structure is isonicotinic acid hydrazide.

### T. B. Effectiveness Sought

► SEVERAL new chemical cousins of the promising anti-tuberculosis drug isoniazid (isonicotinic acid hydrazide) also have shown high activity against tuberculosis in laboratory mice, a team

of chemists from the Squibb Institute for Medical Research, New Brunswick, N.J., told the American Chemical Society.

Four hundred compounds related in chemical structure to the hydrazide drug have been prepared and tested for anti-tuberculosis activity, according to a report by Dr. Harry L. Yale, Kathryn Losee, Joseph Martins, Mary Hosling, Frances Perry and Dr. Jack Bernstein. These compounds were studied in an effort to discover what part of the original drug is necessary for its effectiveness and to determine the possibility of simplifying the drug molecule without decreasing its activity.

While encouraging results have been obtained with a number of the new compounds, additional work will be necessary to learn whether any of the compounds is as effective as the original drug.

Research on the new compounds is a continuation of studies on the problem of tuberculosis begun in 1946 at the Squibb Institute. At that time, an impressive number of infectious diseases appeared to be susceptible to treatment with chemical agents such as the sulfa drugs and penicillin. One major exception, however, was tuberculosis—which remained unresponsive to treatment with any safe chemical agent then known, it was said.

Some synthetic compounds, directly related to the sulfa drugs, had been carefully studied in guinea pigs and human beings without great encouragement, the report continued.

The persistent synthesis of additional related compounds proved equally unrewarding. It was considered unsound, therefore, to embark on

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a search for a useful drug by continuing to follow a lead which showed so little promise.

It appeared that the best course would be to test all possible compounds indiscriminately without preconceived notions as to what the results might be. On such a basis it was possible that the first or the millionth compound tested would fit the exacting requirements of a successful drug.

A plan was evolved for the evaluation of the compounds against a strain of *mycobacteria tuberculosis* in the test tube. Most of the 6,000 compounds so tested did not affect the growth of bacteria and were of no further interest. However, more than a thousand compounds did give evidence of antibacterial activity in the test tube, and these were studied further to determine their effect on tuberculosis in animals.

To carry out the next step it was necessary to develop a test in small experimental animals which would permit the rapid evaluation of compounds on a quantitative basis. Such a test was developed by Squibb workers, using the mouse as the test animal. More than 900 compounds were eliminated at this point because mice treated with them died of tuberculosis as readily as untreated mice. But a small number of these agents did seem to protect mice against tuberculosis, and these were studied to determine their toxicity in other experimental animals. One by one, these few compounds were discarded as toxicity tests showed them to be unsuitable for use in humans.

But one eventful day a report came through which established the fact

that at last there was a drug of real promise.

Isonicotinic acid hydrazide was eminently worthy of notice from the very first because of its startling anti-tuberculous activity in the test tube. Even more startling were the results achieved in mice, where the compound invariably reversed the progress of tuberculosis. Tuberculous mice treated with isonicotinic acid hydrazide regained weight and vigor, lived so long beyond the normal span of infected mice that they were expected to go on to a normal span.

Finally, tests on large animals showed that the compound is remarkably free from toxicity.

Isoniazid, which had been studied independently during the same period by scientists of Hoffman-La Roche, Inc., Nutley, N.J., was tested on human beings shortly thereafter. The dramatic results of these tests were made public early in 1952.

### **Germs Develop Resistance**

► TUBERCULOSIS germs develop resistance to the new TB drug isoniazid 1,000 times faster than they do to streptomycin, two scientists of the Long Island Biological Association said in a report to the American Chemical Society meeting. Their conclusions are based on test tube research conducted on bacteria which produce tuberculosis in frogs.

Only a few of the individual germs develop resistance at first, and these particular individuals show no resistance to streptomycin, or to any of several other antibiotic drugs tested, according to the report, which was prepared by Dr. Waclaw Szybalski, a biochemist, and Dr. Vernon Bryson, a geneticist, of the Biological Assoc a-

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tion's laboratories at Cold Spring Harbor.

For this reason a properly chosen combination of isoniazid with an antibiotic stands a good chance of wiping out all the germs before multiple resistance can be developed, Dr. Szybalski said.

Such a combination of drugs can be used only when there is no biological or chemical antagonism between the drugs, the biochemist warned. And to make the problem more complicated, it was found that if not enough streptomycin is used, antagonism does build up between the two drugs, and the bacteria become resistant to isoniazid much more rapidly than without streptomycin.

Similar, but less pronounced, antagonism was found when insufficient

quantities of aureomycin or terramycin were used with the new drug, but none was developed between isoniazid and para-amino salicylic acid (PAS), amithiozone, viomycin, or neomycin, it was asserted.

In a supplementary statement commenting on the significance of this research performed on tuberculosis germs, Dr. Szybalski expressed the opinion that isoniazid alone should not be used as an anti-tuberculous drug on a large scale until reliable methods have been perfected for preventing the development of resistance through proper combinations with other drugs. Otherwise, he said, there is danger that patients who have been treated with isoniazid alone will develop resistance, and afterward will not benefit from a treatment with a proper combination.

## Sugar Has Industrial Future

► SUGAR MEANS dessert and candy to most people but it has a slow but sure future as an industrial raw material as well.

Among newest research developments listed by *Chemical Week* is its use as a drying agent which has sparked interest among paint and lacquer chemists. Progress has been made in improving use of sucrose in the manufacture of dextran, the blood plasma extender and another highly significant medical advance is development of a superior invert sugar for intravenous feeding.

In the past, industrial use of sugar has not been significant. It is used as sucrose octanitrate in explosive manufacture and a small quantity is used

for foundry cores, welding rods and in mirror manufacture.

Research emphasis is changing to industrial uses because of the ever-present danger of over-supply, and with food uses now taking 97% of the domestic consumption there is little chance of expanding this demand.

Although economists like to call the sugar industry "depression-proof," the yield per acre in sugar areas is startlingly high and indiscriminate cultivation could make it a glut on the market. It is this potential over-supply that researchers are interested in. Until now most research has been on nutritional studies, for example, debunking the once-popular misconception that sugar is the sole culprit of tooth decay.

## Hopeful Progress In Intense Campaign Against Cancer

# Chemicals Fight Cancer

*Reports of use of chemical methods and materials in the medical attack on various forms of malignancy.*

### Three Kinds of Attack

► THE CHEMICAL attack on cancer is three-pronged.

One prong consists of the search for and trial of new chemicals and combinations of them that might destroy the cancer without harm to the rest of the body. Among the newest of these are compounds called ethylene amines developed in the research department of Lederle Laboratories at Pearl River, N. Y. Three of these have now been selected as worthy of trial on patients, following further pharmacological studies.

A second prong of the chemical attack on cancer consists of withholding chemicals from the patient's diet. Some of this work has reached the stage of human trials. The hope of such studies, of course, is to find a way of starving the cancer to death without cutting down too much on food needed by the rest of the body. Signs that this might be good treatment for patients with Hodgkin's disease were reported by Dr. Walter J. Frajola and associates of Ohio State University College of Medicine. The chemicals they withheld are two protein building blocks, lysine and phenylalanine. The diet their patients got during these studies consisted of a cornstarch pudding, "cake," and water mixtures of the essential amino acids, minus the one under study.

Third prong of the chemical attack on cancer consists in finding chemicals that might make cancers more susceptible to X-rays. Sometimes a chemical is given for this purpose but in studies by Dr. W. R. Franks and associates at the University of Toronto, the plan was to try withholding certain chemicals. When they kept copper out of the diet of mice with a transplanted tumor, the tumor grew at a slower rate and was more susceptible to X-rays. Keeping magnesium out of the diet, on the other hand, caused slower growth of the tumors but did not increase the effect of X-rays. If anything, it lessened their effectiveness.

To scientists, the importance of these studies lies in the knowledge gained about fundamental chemical processes under restrictions of copper or magnesium. The effectiveness of X-rays is increased, the copper part of the study suggests, when the amount of catalase in the body is decreased. Decrease in the activity of the enzyme, catalase, would be expected to reduce the rate of removal of any peroxide formed by the irradiation. From such clues might come better methods of treatment.

### Neutrons For Brain Cancer

► SHOOTING slow neutrons from an atomic pile into the head of a patient with cancer of the brain who has had a boron isotope administered to him has shown encouraging results.

Dr. William Sweet, neurosurgeon at the Massachusetts General Hospital

and assistant professor of surgery at Harvard Medical School, has found that boron 10, an isotope of boron that is not radioactive, will go to brain tumors in three times the amount that it goes to normal brain tissues when it is injected into the blood stream. The possibility then exists that if the boron in the head is "shot" with a stream of slow neutrons from an atomic pile, the atoms of boron will disintegrate, destroying the brain tumor but not harming the normal part of the brain.

The 58 patients tested were first operated on to remove most of the brain tumor. The atomic attack was used in an effort to clean up any fragments of the tumor remaining in the brain. The hope is that boron 10 alone eventually can be used to get rid of the entire tumor.

### Drug Halts Leukemia

► SOME CHILDREN who formerly would have been doomed to death within a few months after contracting acute leukemia, cancer of the blood, now live happy, healthy normal lives for as long as two and one-half years.

They take a pill once a day of amethopterin. It is one of the few tasteless medicines known to physicians. With this anti-vitamin of the folic acid class 30% to 50% of children with leukemia have responded to treatment, so that temporarily there are remissions of the disease.

Dr. Joseph H. Burchenal, head of the leukemia section at Sloan-Kettering Institute, New York, reports that of 150 leukemia victims, young and old, before the treatment was discovered 138 were dead within nine months, 10 more died before the end

of the year. The two remaining victims were dead in a year and a half. Of 154 young and old patients who were treated with amethopterin, 61 are still alive at the end of nine months, 46 at end of a year, 12 after one and a half years, and six at the end of two years. One or two children not in this series, said Dr. Burchenal, have lived as long as two and one-half years.

Children can live normally up to the last few weeks of the disease. They come to the out-patient clinic once or twice a week for a general examination. However, they take their pills at home. Once every two weeks the doctors check the bone marrow to watch the count of leukemia cells.

This way they can catch a relapse about two weeks before it would be evident in the general health of the child. The pills are taken only during periods of relapse. Unfortunately, after eight, 10 or 12 relapses leukemia cells become resistant to amethopterin. Then ACTH and cortisone are given. If this creates a remission, there is a slim chance that amethopterin would work for the next relapse. If not, sometimes two or three remissions may be achieved with ACTH and cortisone.

Dr. Burchenal reports that all the parents are grateful for this longer time with their children who they know are going to die. One father wrote that he got to know his son better during the last few years of his life than he might have if he had not realized he was going to die. Dr. Burchenal also pointed out that there is a faint hope that a real cure may be found during the prolonged life.

### Prolong Leukemic Lives

► CHILD LEUKEMIA victims have had their lives prolonged, on the average, three to four months by giving ACTH or cortisone after anti-folic acid chemicals no longer helped, or by the reverse, giving the anti-folics after the hormone chemicals failed.

The hormones apparently have a different primary mode of action on the leukemic process from the anti-follic chemicals. Using first one and then the other of these chemicals does not cure, but this method may be important if sensitivity to the first chemical tried can be reestablished. These studies are reported by Drs. Elizabeth M. Kingsley Pillers, Joseph H. Burchenal, Leonard P. Eiel and Olaf H. Pearson of Memorial Hospital and Sloan-Kettering Institute, New York, in the Journal of the American Medical Association.

### TEM for Leukemia

► TEM, short for triethylene melamine, shows more versatility than other chemicals used in treatment of the leukemias, Hodgkin's disease and other malignant disorders of white blood cell forming tissues. Studies showing this are reported by Drs. Jay H. Silverberg of Pittsburgh and William Dameshek of Boston in the Journal of the American Medical Association. TEM is related to the nitrogen mustards but has the advantages that it can be given by mouth and causes less frequent and less severe reactions. It is not a cure but produces long periods of improvement in some patients.

### Chemical Supplies Cancers

► A CHEMICAL from cancers that brings increased blood and nourishment to

the malignant growth has been discovered by Dr. Kenneth G. Scott and associates at the University of California.

The chemical was extracted from cancers. Its chemical nature is still not completely known, but it is part of a protein molecule and resembles the adrenal gland hormone, adrenalin, or epinephrine as it is called by scientists.

Blood vessels supplying tumors are enlarged by this chemical and the clotting time of the blood is increased from four minutes to more than half an hour. Both these changes make it possible for growing tumors, or cancers, to rob normal tissues of nourishment from the blood.

In normal animals, blood makes up 5.4% of the body weight. In cancerous animals it makes up 7.1%.

### Copper and Iron Blood

► IRON AND COPPER are markedly changed in their concentrations in the blood serum of cancer patients as compared with the normal concentration in the serum of healthy people.

This is reported by Dr. Robert Pirrie, Muirhead Department of Medicine, Glasgow University, in the Journal of Clinical Pathology.

Dr. Pirrie measured the copper in the serum of 40 healthy and 19 cancer-stricken people and found that in those with cancer the copper content averaged more than twice as high as normal, but the iron was well below normal. This was true for all types of malignancies, those observed being as diversified as, among others, cancer of the lung, bone and breast.

### Red Color Test

► A NEW, RED color method of measuring a compound believed involved

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in cancer has been devised by Dr. H. E. Bennett of the University of Washington.

The compound is called sulphydryl and consists of an atom of hydrogen with an atom of sulfur. It appears to be the compound which turns on and off enzyme systems essential to the life and growth of cells, both normal and cancerous. It may do this by forming bonds which tighten or relax components of the protein molecule or which bind the protein molecule to other chemicals which make it function.

Some scientists elsewhere have tentatively concluded that patients with cancer and some other diseases have more sulphydryl in their blood than healthy persons.

To measure accurately the concentrations of sulphydryls in specimens of blood and other tissues, Dr. Bennett adds a red mercury compound to protein. This stains the sulphydryl groups red so that under the microscope they "stand out like flags at Stalin's birthday party," as one observer puts it.

Muscles showed between six and seven times as much sulphydryl as did blood proteins when the groups were counted by Dr. Bennett's colorimetric tests.

Measuring the sulphydryl in relaxed and contracted muscle fibers comes next on Dr. Bennett's research program. The chemistry of muscle movement and of impulse transmission through nerves may be in part explained by future findings in this research, which will also give a means of exploring the part played by sulphydryl groups in normal and cancerous growth.

### Cesium Radiation

► A WASTE product of atomic energy reactors is going to be put to work helping cancer patients.

The waste product is a soft, silvery metal called cesium. More than 6% of the atoms produced when uranium 235 is split is cesium. And this waste product, in its radioactive form, gives off cancer-killing energy equivalent to the million volt X-ray machines.

Only a few of the nation's largest hospitals have these big, supervoltage X-ray machines. A cesium treatment unit can put supervoltage treatment in the hands of every qualified radiologist in the country, in the opinion of Dr. Marshall Brucer, chairman of the medical division of the Oak Ridge Institute of Nuclear Studies.

The following are the advantages:

1. A unit will be good for 30 years without any maintenance cost.
2. When development costs are amortized, cesium units will be available at a fraction of the cost of present supervoltage units.
3. The single-energy radiation beam of about 600,000 volts will deliver a strong dose to the tumor with a minimum of dosage to intervening tissue, particularly when used in multi-port or rotating beam therapy.
4. Adequate radioactive cesium is now available for making large numbers of units as soon as separation processes now on a pilot plant scale are worked out.

### Chemical Stops Pain

► Two OUT OF every three patients with cancer of the bone marrow are getting remissions through treatment with the chemical urethane.

Dr. R. Wayne Rundles of Duke University Hospital<sup>1</sup>, Durham, N.C., emphasizes the treatment is not a cure. But in many cases patients were freed of pain and able to return to work and everyday routines without any symptoms of the disease.

The average lifespan of patients with this cancer, called multiple myeloma, is about 18 months. Urethane is doubling and tripling the survival of some patients.

Multiple myeloma is characterized by great pain, enormous production of abnormal proteins and calcium depletion which often is so great that the bones have a punched-out appearance and may be broken by no greater strain than getting out of bed.

Patients must be regularly treated with urethane and unfortunately may

sooner or later become resistant to the drug.

### **Radioiodine Slows Tumor**

► RADIOACTIVE iodine not only destroys thyroid cancers with its deadly rays but also shuts off the supply of thyroid hormone to slow down all body processes.

In the slowed-down, or myxedematous, state, certain tumors accept the radioactive iodine with its lethal rays, when previously they would not do so, Dr. Earl R. Miller, radiologist at the University of California Hospital, reports.

The growth of some other tumors is retarded under the radio-iodine treatment, even when there is no evidence that the tumors take up the chemical and its exploding atoms.

### ***Chemical Diagnosis for Addiction***

► A NEW AID in the fight against drug addiction has been found. It is a chemical derived from morphine, called N-allylnormorphine. This chemical does not cure morphine addiction, but promises to be a good diagnostic tool for detecting morphine addicts.

If, for example, a doctor wants to know whether a patient is an addict lying about it in an effort to get a prescription for more of his drug, the doctor can give a small dose of the new chemical. The patient's reaction will quickly show whether or not he is an addict.

Persons who have had an overdose of morphine or certain other pain-relieving drugs can be rapidly restored by this new morphine derivative. It acts as an antidote to morphine and its derivatives and to meperidine and methadone.

Its antidotal action may help save new babies whose mothers have been given meperidine to ease childbirth pains. Baby's first breath is taken more promptly, often after the head has been delivered, and the first cry comes faster, doctors have reported.

This childbirth use of the drug and its use as a diagnostic tool for drug addiction are still in the experimental stage, while proper dosages and methods of giving it are checked.

The drug is now available, however, for use as a morphine antidote. It is not active against barbiturates or anesthetics such as cyclopropane or ether. Because it is an opium derivative, it is subject to Federal narcotic laws and is available only on prescription. It is marketed under the trade name, Nalline, by the manufacturer Merck and Co.

## Unusual Sugar Compound Occurs in Sugar Beets

# Inositol Available—Use Sought

► ISOLATION from sugar beet juice of two substances which may find important roles in nutrition and health was announced by two Denver chemists at the American Chemical Society's recent meeting.

The substances are inositol, a vitamin-like material sometimes classified as a member of the B-complex, and galactinol, believed to be the first natural compound of inositol with a sugar ever discovered, according to a report by Robert J. Brown and Robert F. Serro of The Great Western Sugar Company.

Inositol, which has cured hair disorders in mice, is necessary for normal growth in mice and some varieties of yeast. Whether it is needed for human nutrition is still not certain, however. The compound has been suggested as a possible preventive for hardening of the arteries, a frequent cause of heart disease in man. It has also been used in the treatment of liver ailments.

The properties of galactinol have yet to be determined, the chemists said.

The presence of inositol and galactinol in sugar beet juice is a vexing problem to the sugar industry, the chemists pointed out. Since both compounds interfere with sugar refining processes, the industry is seeking to develop new beet varieties which contain them in reduced quantities. It is hoped that these new varieties can be developed once methods of testing the

beets for galactinol and inositol have been evolved.

If the two compounds prove to be of value in future nutrition studies, however, the beet sugar industry may be able to produce a sugar-containing concentrate of galactinol and inositol in relatively large quantities at reasonable cost.

Sugar beets grown in the Rocky Mountain area usually contain less than 1.025 per cent galactinol. In concentrated sugar solutions, the galactinol content may reach about 3.7 per cent. The inositol content of the beets is normally less than the galactinol content.

Inositol also is found in citrus fruits, cereal grains and animal tissues. The corn kernel is a particularly rich source, and most of it made commercially is from corn products. It was isolated from liver by Dr. D. W. Wooley of the Rockefeller Institute, New York, in 1941 and it has been synthesized in the laboratory.

Several years ago, Dr. Wooley discovered that young mice failed to grow properly and developed hair disorders when fed a diet containing all the known vitamins. Fortifying the diet with pantothenic acid, biotin or para-aminobenzoic acid, which are often considered a part of the vitamin B-complex, had no effect. Cures were observed, however, when the diet contained inositol.

In 1950, scientists at St. Luke's Hos-

pital, New York, reported that inositol can effectively reduce the level of cholesterol in the blood of rabbits. Inositol and cholesterol, a fatty substance widely regarded as a possible cause of hardening of the arteries,

were fed to some of the rabbits in their tests. Rabbits given both compounds showed far smaller increases of cholesterol in blood serum than did animals to which cholesterol alone was given.

## *Washing in Cold Water Foreseen*

► DETERGENTS which will wash clothes in cold water, remove stains without extra bleaching, and make fabrics moth-proof and mildew-proof are among the soap industry developments predicted by N. W. Ziels, chief chemist of the Lever Brothers Company, Hammond, Ind., at a meeting of the Joliet, Ill., section of the American Chemical Society.

Home washers today require larger amounts of hot water than many households can furnish. Cold water detergents having no-rinse properties would both reduce the cost of washing and conserve water.

In addition to detergents with anti-mildewing characteristics, and moth-proofing agents which could be applied to woolens from detergents, synthetic detergents with germicidal properties may be developed for use in public washing machines or in stores where automatic washers are rented.

During 1951, total detergents, exclusive of those used for industrial purposes, in the Chicago area were 640,000 cases of bar soaps, 1,240,000 cases of soap powders and flakes, and 1,700,000 cases of non-soap or synthetic detergents.

This is only about 4% of the total soap produced in the United States during the past year, but it would fill a total of 2,600 box cars.

In the past 15 years, our population has increased by 27 million persons, or about 20%. Soap and detergent consumption per capita has risen from 22 pounds to nearly 26 pounds per person, or about 20%. This represents a considerably increased market for detergents. The rise of the new cleaning giant, the synthetic detergent, in the past 15 years has been most amazing. During the first 10-year period from 1935 to 1945, production expanded 75 times. During the next 5 years, production increased 10 times and pushed the tonnage to 1,500,000,000 pounds, or 37.5% of all detergent production, as of the end of 1951.

It is not probable, however, that such an increase will continue or that the non-soap detergent will completely eliminate soap from our daily use. Some experts predict a rise to about 40% of the total detergent consumption.

Future detergents may become so efficient that housewives will not have to use extra bleaching materials to remove stains. Synthetic detergents may be developed which will have anti-mildewing characteristics as a further feature to command the attention of purchasers.

Synthetic detergents are used today to some extent on woolens. It is not unreasonable to hope for moth-proofing agents which may be applied to the fabrics from a synthetic detergent.

New Processes Help Avoid  
Spoilage of Stored Blood

## Blood Bank Life Extended

► A BEAM of light is helping chemists study the intricate process of blood clotting, Robert F. Steiner of the Naval Medical Research Institute, Bethesda, Md., told the American Chemical Society at its Atlantic City meeting.

A light-scattering technique has been used to follow the build-up of fibrinogen, an important protein-containing substance found in blood, during the clotting operation.

The blood clotting process is of crucial biological and medical importance and if it were lacking life would be very precarious indeed, Dr. Steiner said. Quite aside from its intrinsic interest, a fundamental understanding of the phenomena involved would be of great value to medical researchers, who would like to be able to assist the clotting process when it is desirable and to inhibit it when it is not.

The clotting of whole plasma is an extremely intricate phenomenon, as yet only incompletely understood. This work centers attention upon its most important part, which is the polymerization of the protein fibrinogen by the enzyme thrombin.

Fibrinogen is an elongated protein molecule, either rodlike or cigar-like in shape. Purified fibrinogen is acted upon by thrombin to form a slightly altered molecule which possesses the property of spontaneously polymerizing to form a three dimensional lattice. Visually one observes that when a small amount of thrombin is added

to a fluid solution of fibrinogen the latter is transformed to rigid gel, whose properties depend upon the concentration of hydrogen ion and added electrolyte.

In the last decade the light scattering method has developed into a useful tool for the determination of size and shape of large molecules in solution. Through the theoretical work of Peter J. W. Debye and others it is possible to interpret the absolute intensity of light scattered by a protein solution and its variation with angle to the incident ray to give their average molecular weight and dimension.

The technique of light scattering has been employed to follow the latter process and to study the properties of the final gel. At a hydrogen ion concentration close to neutrality the gelatin has been found to proceed as follows. After an induction period whose length depends upon thrombin concentration and concentration of added electrolyte, the fibrinogen polymerizes to form very long thread-like molecules about two or three fibrinogen molecules thick. At high concentrations of electrolyte these interact directly to form a three dimensional network of thin strands, giving rise to the so-called fine clot which is transparent and readily ruptured. The increase in particle size with time levels off as the point of gelation is approached.

As the concentration of added elec-

trolyte is lowered below a certain critical value at this hydrogen ion concentration, the initial polymerization process is quite similar. However, the process of gelation is now accomplished by a very rapid increase in strand radius which continues for some time after the formation of a rigid gel. This gives rise to the opaque "coarse clot," with much thicker fibrin strands. It would appear that at low concentrations of electrolyte the polymerized strands are not stable above a certain size and tend to aggregate laterally.

Another important aspect of the polymerization is the nature of the bonds formed between different fibrinogen molecules in building up the network. The technique of infrared spectroscopy has been applied to dried films of native and clotted fibrinogen.

Preliminary results obtained employing this technique appear to show that no true primary bonds are formed as in organic chemical compounds. It has also been found that the polymerization process may be reversed by relatively mild agents. These results suggest that the clot of purified fibrinogen is formed through the development of relatively weak secondary bonds.

### Use for Plasma Extenders

► OBTAINING enough blood and plasma to save the victims of a major catastrophe would be extremely difficult, since there is no absolutely safe method of sterilizing blood, the American Chemical Society was told by I. S. Ravdin, M.D., John Rhea Barton Professor of Surgery in the Hospital of the University of Pennsylvania.

Both blood and plasma can transmit the virus which causes a form of

jaundice, said Dr. Ravdin. This disease, called homologous serum jaundice, is an acute inflammation of the liver.

The difficulty of preserving whole blood for more than three weeks is another vexing problem which faces the stockpiling program.

There is now a considerable likelihood that we can store red cells for as long as nine months in the frozen state and then inject them intravenously with the reasonable hope that they will live as long as the freshly-shed cell. This is not possible, however, for whole blood.

We must therefore, by every possible means, mobilize our resources for the collection, storage, and preservation of blood. The amount of blood which can be maintained depends on the number of donors which can be obtained. This is also true for plasma, as plasma comes from the blood.

The fact that there are limitations in the amount of blood which can be obtained, in its storage, and the fact that both blood and plasma are apt to transmit the virus of homologous serum jaundice have made it mandatory that we look into the various substances which have been recommended as plasma extenders. Chief among these at the present time are the dextrans, P.V.P. (polyvinyl pyrrolidone), and the gelatins. All of these agents can be made in unlimited amounts. They can be stored for unlimited periods of time. They cannot take the place of blood, but they can extend the usefulness of blood.

The plasma extenders should have a colloid osmotic pressure approximately that of plasma. They should be without effect on any major visceral

function. They should be fluid under all circumstances of temperature. They should be easily manufactured from materials available for manufacturing large amounts. They should be relatively cheap. They should be non-antigenic (incapable of producing antibodies).

### Retards Red Cell Weakening

► A NEW CHEMICAL which may enable whole blood to be preserved for long periods was described to the meeting by Dr. Otto Schales, professor of biochemistry at Tulane University.

Red blood cells normally become weakened during storage and lose their ability to survive in the blood stream, explained Dr. Schales, who is also director of chemical research at the Alton Ochsner Medical Foundation in New Orleans. The new chemical, called dimethylamino-isopropyl-phenotheniazine, shows great promise in retarding this deterioration.

The Tulane biochemist based his work on the novel assumption that this weakening of red cells is due to an enzyme action similar to those taking place during the digestion of food in the stomach and intestines. It was thought that enzymes might be at work during the storage period, chewing away at the covering or "skin" of the red cells. The red cell membranes would then gradually become so fragile and weakened that they could not survive the stress of circulation after they were transfused.

During his research, Dr. Schales measured the gradual increase in fragility in stored red cells and observed the effect of various chemicals on this deterioration process. The phenothia-

zine compound was found to be particularly promising in preserving blood samples. Red cells stored for seven weeks with this chemical were no more fragile than fresh red cells, he reported.

Many investigators have searched for methods to preserve whole human blood for transfusion purposes, but at present it is only possible to keep blood in a suitable condition for 21 days. When that period has expired, the red cells, which are the most important portion of blood, cannot be used any more. The blood stored in blood banks is then separated into cells and plasma. While the plasma may be kept for long periods of time, the red cells must be discarded.

Specialists in this field are very dissatisfied that one must throw away the valuable red cells after only 21 days. Efforts to improve this situation have, however, as yet not been successful.

Cautioning against the impression that the new chemical will solve this problem immediately, Dr. Schales said:

Extensive clinical studies with blood preserved in this manner are needed before it can be decided whether the new chemical is that miracle ingredient which will double or triple the life time of stored blood. Further research will soon decide the practical usefulness of the new preservation method, which would be of enormous value to improve the blood supply at home and especially at far distant areas, where part of the permissible storage period is used up during transportation.

The wavelength of green light emitted by atoms of man-made mercury 198 provides the new atomic standard of length.

## New International Auxiliary Language Used in Scientia International

# Science in Interlingua

► To CARRY the latest scientific information to portions of the world where English is not read easily, Science Service has established an international science journal written in the new international auxiliary language, Interlingua.

Called "Scientia International," meaning international science, it appears monthly. It is a companion to CHEMISTRY and Science Service's weekly magazine, Science News Letter.

The new journal is intended to carry the latest information about science progress to world areas where English is not the usual language. Because of the simplicity of Interlingua, the columns of Scientia International can be read at sight with little difficulty even without study or previous acquaintance with the language.

For centuries men have dreamed of an international language whose words and sounds everyone could understand no matter what native tongue is used every day.

In the last century over 300 international languages have been invented. Some of these like Esperanto, Ido, and Occidental have enthusiastic devotees and even considerable literatures. But no world language has as yet become an international tool for communication and understanding.

The new international language making its bow is not really new in the words that it uses. It is rooted in

many languages of the world. The troublesome intricacies of grammar have been discarded. There is only one verb form in each tense, and nouns, adjectives and verbs do not agree as they must in some more complex languages.

Interlingua, the name of this new international language, has been adopted by a group of scholars who gave birth to the new language, even though in 1907 one of the earlier international languages, did have the same name.

Interlingua is no overnight creation of one linguist or even one group of linguists. No one sat down and theorized as to what an international language should be. Instead almost three decades ago, in 1924, an ambassador-to-be, a chemist, several radio engineers, several educators, editors and linguistic experts started a long and detailed inquiry into what an international language should be.

Only now this work on an international auxiliary language has progressed from the stage of research and theory to a practical auxiliary language ready to be used to bring order into the chaos of world tongues. There are now two basic manuals, an Interlingua-English Dictionary and an Interlingua Grammar.

Interlingua is going to work in various ways. Businessmen are beginning to use it in writing their letters. Pamphlets for world distribution eliminat-

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# **SCIENTIA INTERNATIONAL**

EDITION IN INTERLINGUA DE SCIENCE NEWS LETTER

**Lamieraria**<sup>13</sup> En el diseño mencionado se usa pistolas las cuales se lancen al extremidades del cilindro por explosiones al centro y revuelta con la presión de una compresión se un el producto de recorrido conducido al universidad Stanford sube construcciones como la marina Yamashita. Ello agrega una velocidad de 100 m/s y una fuerza de impacto de 2000 kgf/cm<sup>2</sup>. La expansión en direcciones opuestas reduce la vibración del cilindro a su mínimo, y la ausencia de bolas elimina toda presión lateral del pistón. De tal modo motor esencia usado con más successo para armazones acuáticas en la marina germana. La marina estadounidense intentó usar lo la parva nave y carretera.

des la action de un campo magnetico para probar su-

llas per la italiana...; e scientistas e amicos del sciencis que es de l'interes de la Scienzia International, preferi l'italian per la lingue del scientias que es un lingue international. E scientias que es international require un libre fluxo de informaciones al quatre angles del mundo. In iste, Scienzia International pote assistir Iea. Scienzia in lingues internationais, alla non sengnare limites linguistico, come le spirito del scientias non sengnare limites geografico. La Scienzia International es una as per que le functiones practic de un periodico come Scienzia International es fragmentamente clar, le difficultates a superar per arriantar la interpresia ueque al apparition del prime numero non senva negligibile. Per suocades multe situaciones require que le intime cooperacion de das organizaciones representantes distinguente del reportage scientifico de un lato e del altero

del practice interlingüístico.  
La realización de tal cooperación — organizada por Colombia— ha permitido la realización de numerosas y exitosas conferencias y seminarios, tales como el seminario de la Sociedad de Washington. Miembro del consejo directivo de IALA (International Auxiliary Language Association) y simultáneamente director de *Science Service*, la bien conocida institución dedicada al propagación de informaciones científicas, señor Davis creyó el primer a comprender la posibilidad de establecer una organización que reuniera en su seno las más avanzadas organizaciones. La resultante es *Scientia International*, redactada por IALA y publicada por *Science Service*. A.A.

the need for a dozen linguistic versions by being written in Interlingua. The first periodical, named SCIENTIA INTERNATIONAL, was issued for the first time this summer.

A scientific and educational organization, the International Auxiliary Language Association, abbreviated IALA, with headquarters in New York at 420 Lexington Ave., has car-

ried on the development of Interlingua and is now launching it as an addition to the world's intellectual and commercial resources.

The amazing thing about Interlingua is that the average American looking at it thinks at first glance that it is Spanish or perhaps French or Italian. It is very easy to read for anyone who knows a little of another language and

even those who feel that they have neglected foreign languages find themselves understanding the gist of it at sight.

A Spanish-speaking person is likely to say, as he reads with fluency, "What funny Spanish!" The Frenchman and the Italian will find Interlingua quite familiar. Chinese, Japanese, Arabs, and others who speak Oriental languages will find pleasing the lack of difficulties with grammar.

There is good reason why Interlingua seems so familiar to those who know something about national languages. It is developed from the consensus of three major sources of naturally international words. It uses the vocabulary of science and technology which is common to almost all the languages of the world, both East and West. It uses English roots where these are common to other languages. It has borrowed fundamentally from the Romance languages, Spanish, French, Italian, Portuguese, etc.

The text of *Scientia International* is translated into Interlingua by Dr. Alexander Gode, one of the group of linguists which in the last two decades made a thorough study of the international language problem and devised this new language.

Americans are being invited to send gift subscriptions of *Scientia International* to friends in other countries. The subscription is only \$2 per year.

The following are items from the first few issues of *Scientia International*:

Al secunde congresso international de biochimia a Paris, doctor Felix Haurowitz del universitate Indiana presentava un schema tentativo del

mechanismo de formation del anticorpores intra le cellulas sanguinee. Ille considera anticorpores como specific deviationes in le formation normal de globulina, causate per le presentia del antigenos a cuje destruction illos es adaptate. Tal deviationes occurre in le secunde phase formative del globulina intra le cytoplasma. Le phase precedente esserea le formation, probabilmente intranuclear, de un strato monomolecular de peptido.

Pro le datation comparative de *kjöckenmöddinger*, doctores V. P. Sokoloff e G. F. Carter del universitate Johns Hopkins a Baltimore ha developpate un metodo de analyse geochimic. Illo es basate super le facto que le concentration excessive de nitrogeno, phosphoro, cupro, zinc, stanno, plumbo, manganese, etc. in le *kjöckenmöddinger* original es lentemente assimilate al norma del ambiente. Proque tal assimilation depende de multe e complexe factores, le metodo remane satis crude e ha ante toto valor corroborative; sed illo ha le grande avantage de non esser limitate in tempore como le metodo radiocarbonic que es restringite a circa 25 milles annos.

Le laboratorios del industrias Eastman de productos de distillation (*Eastman's Distillation Products Industries*) a Rochester esseva installate in 1919 quando Germania, previamente le plus importante producente de syntheticos chimic, non poteva plus satisfacer le mercato american. Lor prime lista commercial comprendeva 150 productos. Hodie lor lista enumera alicun 3,500 productos a precios usque a \$60,000 le libra. Illos incluse chitina, facite de conchas de homaro e usate in recercas dietetic; bilirubina,

acite del calculos biliari de bestial e importante pro tests biochimic; etaim butylmercaptano cuje puter es si punjente que on lo usa pro expeller rattos; e ethylmercaptano que ha un si forte odor que on pote usar lo como signal de alarma in minas e ubicunque le ruoto de machinas rende acustic signales inaudible.

In tests conduceite al universitate Glasgow in Scotia, doctor Robert Pirrie ha trovate que le sero de patientes de cancre ha un contento subnormal de ferro e plus que duple normal de cupro. Manca usque nunc omne explication del observation.

Doctor Kenneth G. Scott del universitate de California ha isolate ex canceres un substantia—chemicamente

nondum completamente identificate sed affin a adrenalina—que dilata le venas e retarda le coagulation del sanguine e assi ha le effecto de nutrir le cancre al dispensa del texito normal. Su neutralisation, nunc investigate, dara forsan un methodo a relentar o mesmo arrestar le crescentia de tumores cancerose.

In experimentos al instituto pro recercas medical in London, doctor H. A. Sloviter trovava ancora usabile pro transfusiones post nove menses 70% de specimenes de sanguine immagazzinate mixte con glycerol a un temperatura de minus 79 C. Le methodo essera de importantia practic al minus pro preservar sanguine del typos plus rar.

## Strange Synthetics Made

► STRANGE SYNTHETIC organic chemicals with names of the tongue-twisting variety are made at Eastman's Distillation Products Industries laboratories, Rochester, N. Y., out of such strange raw materials as lobster shells and bovine gallstones.

The relatively scarce chemicals are supplied to scientists throughout the world at prices that range up to \$6,000 a pound.

Chitin, a basic raw material for an important compound used in nutrition research, is extracted from lobster shells. Bilirubin has a bright red color useful to medical scientists testing human body functions. It is made from gallstones taken from cattle. Since all cattle do not have gallstones, bilirubin is comparatively scarce.

Farmers like butylmercaptan for its horrible, skunk-like odor. Some farmers used it to drive rats out of their grain storage bins. But the rats fled to grain bins on neighboring farms and the resulting situation created harsh feelings.

Ethylmercaptan smells worse than rotten eggs. The chemical is useful as a sort of olfactory alarm signal in mines when the noise of mining machinery would make warning sirens or bells difficult to hear.

Eastman began the DPI laboratories in 1919 when World War I cut off America's chemical trade with Germany, the world's top producer of synthetic chemicals at that time. About 150 compounds were prepared by DPI labs at first, but today the catalog lists more than 3,500.

## Atomic Bomb Element Discovered In Red Stars

# Technetium, No. 43, In Stars

► TECHNETIUM, the first chemical element to be discovered through atomic bombardment, exists in stars. Several lines of technetium have been identified in the fanned-out light of red S-type stars by Dr. Paul W. Merrill of Mount Wilson and Palomar Observatories.

It is surprising to find an unstable element in the stars. This may indicate one of several things:

1. A stable form of technetium actually exists although it has not yet been found on earth.

2. These stars rich in the little-known heavy elements zirconium and barium somehow produce technetium as they go along.

3. The S-type stage of stellar existence is relatively short.

Technetium is an explosion product of the atomic bomb. It is element 43, and it was first identified in a piece of molybdenum that had been bombarded with neutrons in the University of California cyclotron at Berkeley. Today it is most plentifully obtained as a product of the splitting of uranium atoms in AEC nuclear reactors at Oak Ridge, Tenn.

Samples of this rare element, ob-

tained from Oak Ridge, were heated at the National Bureau of Standards to produce its typical spectrum, and compared with the sun's rainbow colors. Dr. Charlotte E. Moore-Sitterly, working with Dr. W. F. Meggers in the Bureau's spectroscopy laboratory, found at least one identical line in both spectra. This indicates that technetium probably exists in the sun.

Photographs taken by Dr. Merrill with the 100-inch telescope and others taken recently by Dr. I. S. Bowen with the 200-inch telescope, show several technetium lines in the spectra of S-type stars. This is particularly true of certain variable stars which regularly take about a year to increase and decrease in brightness. Dr. Merrill has reported to the National Academy of Science.

The bothersome problem about the existence of technetium in the sun and other stars is that the period of existence (called "half-life") of any kind of technetium known here on earth is relatively short. It is measured in mere hundreds of thousands of years, a short time for material in a star. If a longer-lived form of technetium were discovered on earth, it would fit into the picture better.

A new radiation watchdog which sounds an alarm when dangerous atomic radiations become harmful to human tissues will soon be on the job in many American cities.

An attempt is being made as a part of the atomic energy program to make photosynthesis, the capture of solar energy by usable chemicals, take place outside the living cells.

For Important Measures  
Of Very Small Quantities

## New Laboratory Instruments

► A NEW balance 10 times as sensitive as conventional projection balances made its debut at the second annual Research Equipment Exhibit at the National Institutes of Health in Bethesda, Md.

The balance is for fast, accurate weighing of small quantities, up to about 7 ounces (200 grams). Weighings to one-tenth of a milligram can be made within seconds by straight

projection, or to one-hundredth of a milligram by sensitivity shift and an additional set of 10 weights. It is manufactured by Voland and Sons, Inc., of New Rochelle, N. Y.

A slicing machine with a glass knife that cuts slices too thin to be seen with the naked eye was shown by the International Equipment Co. of Boston. Known as the Minot Rotary Microtome, this slicer cuts much-thinner-



► MORE SENSITIVE BALANCE—Miss Bunny Geisbert of the National Institutes of Health staff shows how the newly developed balance, 10 times as sensitive as conventional balance, is operated.

than-paper sections of nerve and other tissues for examination with the electron microscope. The actual thinness of the pieces is in the order of one-twentieth to one-fortieth of a micron, microns being so small that it takes more than 25,000 of them to make one inch.

For measuring the amount of carbon dioxide, oxygen, nitrogen or carbon monoxide in a pin prick amount of blood, when the test needs to be made on a new baby or a small laboratory animal, there is a new gas analysis apparatus called the Kopp-Natelson Microgasometer available

through E. Machlett and Son of New York.

The acidity or alkalinity of soils, water, and foods during the canning process can be measured easily, accurately and on the spot by relatively unskilled personnel with a new machine, called the Compax pH Meter, made by Coleman Instruments, Inc., of Maywood, Ill. The electrode system for this folds into a five-pound case, so that when the cover is closed the system is off. A mercury cell battery like that in modern hearing aids is part of the equipment that gives service for more than a year without going dead.

### Terramycin Structure Discovered

► THE CHEMICAL structure of terramycin, one of the "Big Five" antibiotic drugs, has been worked out. This chemical feat was achieved by scientists in the laboratories of Chas. Pfizer and Co., Brooklyn, where the drug was discovered, and Dr. Robert B. Woodward of Harvard, co-discoverer of the synthesis of quinine and of an important step in the synthesis of cortisone.

Hope of synthesizing terramycin, however, is considered slim because of its complex molecular structure, said to be one of the most complex ever found in nature and unique among known antibiotics.

But even if we must continue to depend on mold fermentation processes for the supply of this healing drug, chemists may, now that its structure is known, be able to change it a little and thus produce new medicines. Knowledge of its chemical structure may also help explain the mechanism of antibiotic action and the way in which molds build up antibiotics.

Besides Dr. Woodward of Harvard, seven Pfizer scientists took part in the two-year research leading to discovery of terramycin's chemical structure, announced in the Journal of the American Chemical Society. The seven are: Drs. K. J. Brunings, F. A. Hochstein, C. R. Stephens, L. H. Conover, Abraham Bavley, Richard Pasternack and Peter P. Regna.

The terramycin molecule, they found, consists of carbon, hydrogen, nitrogen and oxygen atoms. Its high oxygen and nitrogen content is considered responsible for its getting along well with fluids and tissues of the living body. In body fluids it apparently acts like a tiny magnet with positive and negative poles that enable it to combine with various kinds of chemicals much as body protein substances do.

In the basic skeleton of the terramycin molecule are four rings of six carbon atoms each, fused into a bar pattern.

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## For The Home Lab

# More About Phosphorus

by BURTON L. HAWK

► IN OUR previous discussion on phosphorus (CHEMISTRY, Sept. 1952), we considered chiefly the bizarre and unusual properties of the element. Now let us investigate the chemical properties more thoroughly. We will find that phosphorus can do other things besides shine in the dark.

### Oxides

When phosphorus burns in air, dense white clouds of the trioxide,  $P_2O_3$ , and pentoxide,  $P_2O_5$ , are formed. The trioxide reacts with water to form *ortho*-phosphorus acid,  $H_3PO_3$ , or with a limited amount of water to form *pyro*-phosphorus acid,  $H_3P_2O_5$ , and *meta*-phosphorus acid,  $HPO_2$ . Similarly, from the pentoxide we obtain *ortho*-phosphoric acid,  $H_3PO_4$ , *pyrophosphoric acid*,  $H_4P_2O_7$ , and *metaphosphoric acid*,  $HPO_3$ .

Place a small piece of yellow phosphorus in a deflagration spoon. (Careful! Do not touch with bare hands.) Ignite the phosphorus and lower the burning element in a jar with about one-half inch of water in the bottom. Partly cover the jar with a glass plate. What we are trying to do here is to trap as much of the smoke as possible in the jar and yet allow sufficient oxygen for the phosphorus to continue burning. When the phosphorus no longer burns, remove it from the jar quickly and cover entirely with the glass plate. You now have a jar of smoke with a little water. Holding

the glass plate securely, shake the jar vigorously until all of the smoke dissolves in the water. Now the \$64 question is—which phosphorus acid do you have in the jar? Meta-, ortho-, pyro-, or ous? From the information given in this article, can you figure it out?

Drop a piece of litmus paper in the solution to test its acidity. Maybe your acid is stronger than you think. Transfer the solution to a test tube. Drop in a small piece of zinc and heat. Is the metal attacked?

The most common acid of phosphorus is *ortho*-phosphoric. In the anhydrous state (hydrogen phosphate) it is a colorless, crystalline solid, but is best known as an 85% aqueous solution. When heated to 200 degrees it gradually changes to *pyrophosphoric acid* and above 300 degrees it becomes *metaphosphoric acid*.

### Phosphates

Phosphoric acid forms three series of salts: *primary*, such as mono-sodium phosphate,  $NaH_2PO_4$ ; *secondary*, such as di-sodium phosphate,  $Na_2HPO_4$ ; *tertiary*, such as tri-sodium phosphate,  $Na_3PO_4$ . The pyrophosphates and metaphosphates are prepared by heating the acid salts of orthophosphoric acid. But let's not get too involved. The phosphate family is a large one with "uncles and aunts and cousins by the dozen."

To observe a few of the many colorful phosphates, prepare solutions of the following compounds in separate

test tubes: silver nitrate, ferric chloride, cobalt chloride, nickel sulfate, cupric sulfate and lead nitrate. Add a small quantity of trisodium phosphate solution to each tube and note the lovely pastel shades of yellow, brown, lavender, green, blue and white.

### Halogen Compounds

Phosphorus unites directly with chlorine to form the trichloride,  $\text{PCl}_3$ , or pentachloride,  $\text{PCl}_5$ , depending upon the abundance of chlorine. Ignite a small piece of phosphorus and lower it into a jar of chlorine. It will continue to burn feebly. (Chlorine is prepared by heating manganese dioxide with dilute HCl in a test tube. Collect in a jar by displacement of air.)

The union of phosphorus with iodine is more spectacular. Place a small piece of carefully dried phosphorus in a large evaporating dish. Sprinkle a few crystals of iodine on the phosphorus. Keep your face away! The mixture will suddenly burst into flame accompanied by large clouds of smoke. As the result of this elaborate performance, we have phosphorus triiodide,  $\text{PI}_3$ , a red compound decomposed by water.

### Tests

To determine whether a compound is a phosphate you can use the following test. Heat a very small quantity of the unknown with an equal quantity of magnesium powder, charcoal powder and sodium carbonate until the flame reaction occurs. Pour a little

New chemicals showing excellent promise for use in the preparation of synthetic rubber, plastics, and many other products have been developed from gum turpentine.

The control of soil insects in general is one of the most promising fields for agricultural progress.

water on the residue and smell cautiously. If a phosphate was present, the disagreeable, garlic-like odor of phosphine can be detected.

To determine whether a given phosphate is ortho or meta, simply add a solution of silver nitrate. Ortho compounds form a yellow precipitate, while a white precipitate is obtained with metaphosphates.

### Matches

No treatise on phosphorus would be complete without the mention of matches. The "strike-anywhere" match contains phosphorus sesquisulfide along with paraffin, a combustible substance (sulfur), and an oxidizing agent (potassium chlorate). When the match is "struck," the heat of the friction ignites the phosphorus compound. This flame then sets forth the reaction between sulfur and potassium chlorate, which in turn ignites the paraffin and finally the wood itself.

The "safety" match contains the oxidizing agent, potassium chlorate, and a combustible substance, usually antimony sulfide. The side of the box, where the match is "struck," contains red phosphorus and an oxidizing agent bound together with glue and abrasive.

There are many other important uses of phosphorus and its compounds. The phosphates are used in fertilizers ("Superphosphate"), baking powders, detergents, water softeners, fireproofing agents, photographic developers, etc. Indeed, a large, complex, but extremely useful family!

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## Chlorinated Phenols Skin Disinfectants

# New Germicide for Soap

► GERMICIDE research which may yield better antiseptic household soaps, shampoos and skin lotions was described at the American Chemical Society's recent meeting by Dr. Max E. Chiddix of the General Aniline and Film Corporation's central research laboratory at Easton, Pa.

In a study of a new class of germicides called chlorinated phenols, Dr. Chiddix said, a relationship was found between their acidity and their germ-killing activity in the presence of soap, as tested against an organism commonly found on the skin. He said the information obtained in the study may lead to the synthesis of superior germicides for use in household soaps, detergents, shampoos, medicated skin cleaners and surgical scrub-up soaps, as well as in skin lotions and deodorants. Stanley H. Hesse and Marjorie R. Williams of General Aniline and James Oelberg of the Armour Laboratories, Chicago, were co-authors of the paper, which was presented before the Society's Division of Biological Chemistry.

The problem of finding a good way to disinfect the skin is an old one, Dr. Chiddix pointed out. Bacteria and fungi of all kinds are taken up by the skin, especially by the hands. Washing with ordinary soap removes many germs along with the dirt, but does not get at those bacteria which reside in the lower layer of the skin. Many of these bacteria which are the normal residents of the skin are harmful. The

germicides prepared in this work were tested against one type of bacteria which is a frequent cause of abscesses, boils, and some surgical infections.

Attempts to find an antiseptic soap date back to the work of the German bacteriologist, Robert Koch, in 1881. Several investigators have examined compounds based on mercury, but these compounds were not satisfactory because they were toxic and irritating. Many other compounds derived from phenol (carbolic acid) have also been tried, but although these were effective at high concentration they lost their effectiveness at a concentration of 5 per cent or lower in soap.

With the discovery by Dr. W. S. Gump that certain phenol derivatives retain their germicidal activity in a large excess of soap, a new class of phenolic compounds became of interest for this application. A large number of compounds of this class have been examined by the authors, but only certain ones were found to have good germicidal properties in soap. The present study is an attempt to find the reason behind the activity of these compounds, and to prepare better germicides for use in soap and detergents.

At present, several companies are selling bar soaps which contain one of the germicidal compounds of this new class. The increasing sales of these soaps indicate that the public is becoming educated to the need for a

more effective way to kill bacteria on the skin.

These compounds contain two acidic parts, one strong and one weak. It is thought that the reason for the difference between the two acidic groups is an interaction between the two, caused by actual contact of a type known as hydrogen bonding. One indication that this contact was possible was obtained by building a model of the compound from a set of atom models.

It is postulated that the relationship between germicidal activity and acidity exists in these compounds because the high acidity of the first phenolic group increases the rate of absorption of the compound by the bacteria and the low acidity of the second group enables it to take part in the toxic reaction as an unneutralized phenolic group in spite of the high alkalinity of soap.



► *It's a new onion-skin paper with chlorophyll!"*

Long-lived Np Isotope  
Found in African Ore

## Natural Neptunium Discovered

► THE FIRST TRACE of natural neptunium 237, discovered in ore from the Belgian Congo, was reported to the American Chemical Society's Atlantic City meeting. This discovery fulfills the 1947 prediction of Dr. Glenn T. Seaborg, Nobel Prize-winning chemist of the University of California, that this isotope — first synthesized in 1942 — and the atomic fuel plutonium would be found in minute quantities in nature.

Only three ten-billionths of an ounce of neptunium 237 has been isolated from the African pitchblende ore, and scientists will probably have to rely for any usable quantities on the synthetic material obtained from the cyclotron bombardment of uranium or from the operation of the Atomic Energy Commission's uranium piles, it was indicated in the report, presented by Dr. Donald F. Peppard of the Argonne National Laboratory, Chicago, G. W. Mason, P. R. Gray, and J. P. Mech are co-authors.

Nevertheless, the isolation of naturally-occurring neptunium 237 may have considerable theoretical significance.

Neptunium, named for the planet Neptune, was the first transuranium element to be discovered. In 1940, Dr. Edwin M. McMillan, who shared the 1951 Nobel Prize with Dr. Seaborg, and Dr. P. H. Abelson of the University of California succeeded in producing the neptunium 239 isotope with the aid of a cyclotron. Later investi-

gations showed that neptunium is similar in chemical properties to uranium.

Neptunium 237, the second isotope, was discovered early in 1942, also being made by the Berkeley cyclotron.

Dr. Seaborg's prediction was based on the observation that uranium-bearing ores behave, in a miniature fashion, like atomic piles in so far as the synthesis of byproducts is concerned. The first part of the prediction was proved valid in 1951, when plutonium was found in nature by Dr. Seaborg and his associates at the University of California and also by a group of scientists at the Argonne National Laboratory, including Dr. Peppard, Mr. Mason, and Mr. Mech.

Neptunium 237 is not highly radioactive as compared with the other transuranium elements. Its half-life, the time required for half of any sample to disappear by radioactive decay, is 2,250,000 years. This is in sharp contrast to neptunium 239, which has a half-life of less than 3 days.

The low amount of "alpha" radiation given off by neptunium 237 makes this element valuable in radiation studies. Special equipment is not required in handling provided reasonable precautions are taken. The other transuranium elements are so highly radioactive that special techniques are necessary.

Neptunium 237 is considered to be the long-lived parent of a radioactive family known as the "4n plus 1 se-

ries." This series remained unknown until 1947 when uranium 233 was synthesized by bombardment in an atomic pile. Only one member of the series, the non-radioactive element bismuth, was known to exist in nature until the present isolation of neptunium 237.

Three similar radioactive families have been known for some time. All

of the long-lived parents of these series—thorium 232, uranium 238 and uranium 235—are known to exist in nature.

The maximum neptunium content of the Congo ore is about one-tenth that of the plutonium content, Dr. Peppard said. Previous studies have shown that the plutonium content is about one ounce per four million tons of ore.

## *Sulfur Mined Without Fresh Water*

► ESSENTIAL sulfur can now be extracted for the first time from underground salt domes at locations where fresh water is not available and the cost of piping it from distant sources would be prohibitive.

Freeport Sulphur Company will use the new process to mine a deposit of elemental sulfur, or brimstone, at Bay Ste. Elaine, a marshy area near the Gulf of Mexico, 35 miles from the only source of fresh water.

The Freeport plant, first to use the process, itself is an innovation. It will be built on a huge barge, from which nearly 2,000,000 gallons of superheated water a day will be pumped underground to melt the brimstone.

The process consists in heating the brackish or sea water under pressure to 325 degrees Fahrenheit, more than 100 degrees above the normal boiling point, and in removing from the water all but a minute part of the corrosion-dealing oxygen.

Special controls prevent the decomposition in the salt water of scale-depositing bicarbonates, the chemicals

that make water hard, leave rings on bathtubs and cause "tattle-tale" gray. At the same time, the removal of oxygen reduces corrosion which otherwise would be excessive because of the extreme heat.

The usual way to eliminate scale would be to remove all or part of the calcium and magnesium by chemical treatment. Due to the large amount of these elements in sea water, however, costs for this method would be extremely high.

Oxygen is removed in an apparatus consisting of a tower in which cold sea water flows downward through packing. Water in the upper part of the tower is contacted with flue gases from steam boilers and in the lower part with the products of combustion of natural gas.

As the temperature of the water is raised, the gases de-aerate it, reducing the oxygen to less than one pound of gaseous oxygen per 10,000,000 pounds of water. The water is heated to 190 degrees Fahrenheit and then raised to mining temperatures with steam in indirect heat exchangers.

## Seek Noisy Radio Stars With New Telescope

# Cause of Cosmic Hisses Sought

► A SEARCH for radio stars, those peculiar stars whose cosmic hisses can be picked up on earth, will soon begin at Ohio State University. A radio telescope 160 feet long and 12 feet across is being constructed at Columbus to record their noisy signals.

The telescope, to be one of the largest in existence and the only one of its particular design, is being built under the direction of Prof. John D. Kraus. The instrument will use spirally wound antennas which Prof. Kraus invented. It will operate on the ultrahigh frequency of 250 megacycles.

The completed instrument will consist of an array of 48 helical beam antennas arranged in eight units and mounted on a long, movable steel cradle. The new radio telescope goes into operation upon completion of two units. As the antenna size is increased through the addition of units, it will reach farther out into space and do a better job of separating radio waves that come from stars located close together in the sky.

Radio telescopes are an astronomer's "ears" just as optical telescopes are his "eyes." Radio telescopes have to be larger than optical telescopes, the largest of which is not quite 17 feet across, because radio waves are so much longer in wavelength than visible light.

While the new radio telescope searches for stars and clusters of stars that broadcast cosmic static to the

earth, the university's optical telescopes will be turned on the same area of the heavens and the work of the two types of telescopes coordinated. To date over a hundred stars are known to be hissing at the solar system, but astronomers still are not sure just what they look like. Some day the stars responsible for this "frying" sound may be located exactly through this and similar surveys.

Only one other American university, Cornell, today is active in the field of radio astronomy. Cornell has two installations, one at Ithaca, N. Y., and the other at Sacramento Peak, N. Mex. Here particularly interesting research is being conducted on the sun.

The Naval Research Laboratory in Washington, D.C., boasts of one of the world's most versatile radio telescopes. Its basket-shaped instrument is 50 feet across. The instrument was designed to pick up super high frequency signals of 1,000 megacycles. The National Bureau of Standards, with its instruments at Sterling, Va., was one of the first groups to enter the field of radio astronomy.

In all there are only several dozen radio telescopes in the world. Besides the United States, they are to be found in England, Australia, France, Canada and the Netherlands. The world's largest, over 200 feet across, belongs to the University of Manchester in England. A few, on the other hand, are so small they are easily portable.

## U. S. Soil Scientists Advise Trying Small Quantities

# Soil Conditioners "Experimental"

► FARMERS, HOMEOWNERS, and others interested in the new chemical "soil conditioners" widely advertised this year are advised by the U. S. Department of Agriculture to use these materials at present only on an experimental basis.

Some of these materials are known to improve the structure of heavy clay soils. (See *CHEMISTRY*, Jan., 1952) Experimentation with them is, however, in an early stage. A statement issued by the Bureau of Plant Industry, Soils, and Agricultural Engineering in reply to many inquiries makes the following points:

It has long been known that soil organic matter, manures, composts, peats, and similar materials contain substances that bind and stabilize small soil particles into larger, crumb-like particles or "aggregates" which resist breakdown by water. The development of synthetic soil aggregate stabilizers ("soil conditioners") is an attempt to prepare chemical substances effective for this purpose. It should be noted that natural organic materials leave beneficial effects in addition to those of forming and stabilizing soil aggregates (crumb-like particles).

Several synthetic compounds including such chemicals as acrylates, polyacrylates, polyacrylonitrile compounds, maleic acid derivatives, and other materials of various kinds have been shown to be effective in forming and maintaining soil aggregates that resist breakdown by water. Rates of application have considerable influence

upon the extent of aggregate stabilization. As a rule, an application at the rate of about 2,000 pounds of active ingredient per acre to the top six inches of soil has been found to give a near maximum degree of aggregation. Dilute solutions and powders of differing formulas would effectively treat correspondingly smaller areas or shallower depths per pound of material.

Some manufacturers indicate the nature of the chemical compounds that they use. Others do not. Some of the materials offered for sale are powders with a high percentage of active ingredient. Other powders are mixed with inert substances to aid in uniform application to the soil and to prevent caking of the chemical before or during treatment. Other products are sold as water solutions containing a relatively low percentage of active ingredient.

Purchasers of soil-conditioning chemicals should buy the products only with an experimental point of view at the present time. Soils vary in their response to these chemical treatments. Work to date indicates that these conditioners are most effective on soils with high clay and silt content and are not effective on soils with very high sand content. Soils which already have good structure naturally will not show great improvement. It is, therefore, suggested that only small quantities be purchased until the grower is convinced by experience that better soil conditions gained from their use are worth the cost involved.

Weeds That Never Come Up,  
New Insecticides Foretold

## Weeds and Insect Pests Foiled

FARMERS and gardeners can look forward to the day when weeds will never get their heads above the ground.

Pre-emergence treatment, that is, application of a chemical weed killer after the crop has been planted but before it breaks through the soil, represents a relatively new method of weed control, Dale E. Wolf of E. I. duPont de Nemours & Company, Inc., Wilmington, Del., said at a symposium on herbicides before the American Chemical Society recently.

In general there are two types of pre-emergence treatment, contact and residual. In contact treatment a chemical is applied which will kill weed seedlings present before the crop emerges. Most of the chemicals applied this way would also destroy the crop plants if they were above ground at time of spraying. Herbicides used in this manner are certain petroleum oils, phenolic contact herbicides, and potassium cyanate. These do not leave a toxic residue in the soil.

A residual pre-emergence spray kills weed seedlings that are present at time of treatment, and leaves a residue on the soil that kills seedlings that emerge after treatment. Successful treatment depends on a lower concentration reaching the crop seed zone than the upper  $\frac{1}{8}$  to  $\frac{1}{4}$  inch where most weed seeds germinate, and a greater physiological tolerance of the crop than the weed.

A large number of investigators in all parts of the country have conducted

experiments with a wide variety of chemicals on many crops using residual pre-emergence treatments. More information must be obtained before the practice will be adopted on large acreages.

Chemicals which have shown most promise for the purpose are 2,4-dichlorophenoxyacetic acid (2,4-D); calcium cyanamide; 3-(*p*-chlorophenyl)-1, 1-dimethylurea (CMU); pentachlorophenols; salts of dinitro-o-secondary butyl phenol; sodium 2,4-dichlorophenoxyethyl sulfate; and meta-chlorophenyl isopropyl carbamate (chloro IPC).

If we were to guess what properties would be present in the perfect pre-emergence chemical we would say it should have low water solubility, ability to resist fixation in the soil, and ability to remain in the soil in an active form for 3 to 4 months and then be rapidly decomposed so as not to leave a residue affecting the crops which follow.

Some day we may find chemicals specific enough to kill all weeds without injuring certain crops by nature of the tolerance of the crop itself. In the meantime the chemicals available today are effective, and with more fundamental information on the factors which affect herbicidal efficiency of each one of these we will be able to use them where they are best adapted.

### Thunder God Vine

► THE "THUNDER GOD VINE," a Chinese shrub used for centuries to pro-

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tect crops from pests, may yield new insecticides which insects literally can't resist, a Department of Agriculture chemist said at the meeting.

Transplanted from the Orient, the stocky, twining shrub is now being cultivated successfully in the department's garden at Glenn Dale, Md., and in several sections of the country, according to Morton Beroza of the Bureau of Entomology and Plant Quarantine, Beltsville, Md.

In tests so far conducted on American insects, the powdered roots of the Thunder God Vine have proved effective against the larvae of the codling moth, the European corn borer and the diamond-back moth, Mr. Beroza said. Imported cabbage worms also are killed by the root powder.

These insects get their food by chewing fruits or vegetables. The insecticide has little or no effect on insects that live on the juices they suck from inside plants. It is therefore a stomach poison and not a contact insecticide. In spite of its toxicity to chewing insects, the insecticide does not appear to be toxic to warm-blooded animals.

This may be an important factor in future research on the resistance which insects build up against insecticides. Scientists have found that such insects as flies and mosquitoes gradually become accustomed to small doses of certain insecticides, particularly many of the modern synthetic compounds. As a result, higher concentrations of insecticide are necessary in subsequent applications to kill the resistant strains. These high insecticide concentrations may be dangerous to human beings or farm animals.

In general, insect killers made from natural sources have not induced such

resistance, Mr. Beroza asserted. Natural compounds, such as those found in the "Thunder God Vine," may prove valuable in formulating so-called permanent insecticides which do not require progressively higher concentrations to retain their effectiveness.

Chemists have succeeded in isolating a quartet of closely-related chemicals which provide the insecticidal power of the vine, Mr. Beroza reported. Found in the bark of the roots, the chemicals—known as wilforine, wilforgine, wilfordine and wilfortrine—have the same basic chemical structure. The names are derived from *Tripterygium wilfordii* Hook, the technical name for the Thunder God Vine.

The structure of these four compounds has been studied as a step toward the eventual synthesis in the laboratory of the vine's active principles. Although the structure of the compounds has now largely been determined, their complex nature rules out complete synthesis at present. The continuing research program may suggest simpler compounds which would make valuable insecticides.

### Arsenic for Grasshoppers

► DISCOVERY of a new arsenic insecticide which is said to be effective against grasshoppers, termites and a variety of beetles, weevils and bugs was announced by Dr. Roland M. Kary of the American Smelting and Refining Company, Barber, N. J., at the American Chemical Society's meeting.

The new insecticide, designated simply as Compound A-42, has three times the potency of DDT in controlling flour beetles, Dr. Kary reported.

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It was said to be about 130 times more poisonous to the flour beetles than calcium arsenate, twice as toxic to the Mexican bean beetle, ten times more toxic to the German roach and four times more toxic to the Colorado potato beetle.

Termites are killed by mixtures containing only 0.05 per cent of Compound A-42, according to Dr. Kary, who synthesized the insecticide. A dose of 0.10 per cent Compound A-42 destroys granary weevils and 1 per cent kills carpet beetles. Grasshoppers succumb to solutions of half a pound of the chemical in 100 gallons of water, while Japanese beetles can be controlled by a 5 per cent dust formula.

Field tests are now being conducted on a great variety of crops in important growing areas throughout the United States, Europe and New Zealand. The results of these tests largely will determine the compound as an insect killer.

New insecticides may spend years in the laboratory and in the hands of qualified specialists before they are made available to farmers and home-makers, Dr. Kary pointed out.

Compound A-42, known technically as arsenomethane As-1,2 disulfide, is an "organic" arsenic substance. Such compounds are generally less harmful to human beings and animals than the poisonous inorganic arsenicals, such as lead arsenate, calcium arsenate and sodium arsenite—all of which are used as insecticides.

The discovery of Compound A-42 was partly accidental, Dr. Kary admitted. While attempting to synthesize another chemical, he formed Com-

pound A-42 as a by-product. The original chemical remains a laboratory curiosity, while Compound A-42 may become the forerunner of a new series of effective arsenic insecticides.

Assisting Dr. Kary in the Compound A-42 studies were Dr. Y. E. Lebedeff, superintendent of chemical research for the American Smelting and Refining Company, and three Rutgers University scientists—Dr. Bailey B. Pepper, head of the department of entomology; Dr. J. M. Ginsberg, a chemist, and P. L. Pontoriero, an entomologist.

### Fragrant Vapor Control

► MAKING a chemical laboratory smell like an apple orchard or a pea patch may help scientists conquer rampaging insects, Dr. Amos Turk of the W. B. Connor Engineering Corporation, Danbury, Conn., told the chemists.

In studying the migrations of insect pests, it may be revealing to determine how strongly a particular plant odor influences the insects' travels—either as an attractant or as a repellent, said Dr. Turk, who is director of research and development for the engineering firm.

If this can be determined experimentally in the laboratory, scientists will gain priceless information about the habits of insects. This information could be used in predicting or controlling these habits, a valuable aid in the fight against the pests.

Setting up such laboratory tests, however, can be a rather intricate task. It is necessary to duplicate and maintain the fleeting borderline of odor concentrations often found in nature. This could be done in the

laboratory by pumping small amounts of vapor containing the desired odor into an enclosed space.

To set up a low vapor concentration in a space merely by a single shot of the required gas is ineffective because the gas quickly dissipates with nothing to take its place, Dr. Turk explained. The problem can be solved by setting up a system in which the required gas or vapor is continuously injected into the space and simultaneously removed from it at a controlled rate. This results in a constant gas or vapor concentration even at very low levels. It is analogous to, let us say, the odor level in a blossoming apple orchard: the apple aromas are being continuously discharged into the atmosphere and, at the same time, continuously dissipated by the wind. The

balance of these two opposing processes results in the level of apple blossom odor intensity which is characteristic of the particular orchard and its surroundings.

The protection of stored fruit against the ravages of fungus diseases was cited by Dr. Turk as another example in which the control of vapor concentrations is an important factor. A very small amount of a toxic gas is added to the air in the fruit storage space.

When such a method is used, it is essential to prevent the concentration of the toxic gas from reaching the point where it becomes dangerous for humans, Dr. Turk declared. It is therefore necessary to set up a system in which the desired low gas concentration is reliably maintained.

## Metal Coating For Oxide-Coated Metals

► METAL PLATING and solder stick better to oxide-coated metals and glass by improved methods using evaporation techniques developed by the Army Engineer Research and Development Laboratories. Excellent adhesion to the oxide coatings that form in ordinary temperatures on aluminum, chromium and titanium can now be made.

Some metals are difficult to electroplate or solder due to poor adhesion to their natural hard tenacious oxide coatings. Work here was to find methods to secure adhesion to such metals by a process that includes their oxides. Evaporated films of most metals that form hard adherent oxide coatings can be caused to adhere tenaciously to their own and other oxides, scientists state.

Evaporated films of some metals such as gold, silver and copper, show poor adhesion to oxides. However, a metal of the latter group can be made to adhere to a metal of the former group, aluminum, chromium and titanium, by high vacuum techniques.

The vapors of the two metals are deposited at the same time in such a manner as to eliminate the oxide coating which hinders adhesion. Thus, to coat titanium with copper, titanium is first evaporated on the oxide-coated titanium. At the first evidence of titanium deposition, the evaporation of copper is begun. At the first copper deposit, the titanium source is turned off and the copper evaporation continued until no titanium shows through the surface. The resulting surface can be soldered to directly or can be built up by electroplating.

## Proteins and Raw Materials From New Sewage "Farms"

# Algae Tackle Waste Problem

► SEWAGE "FARMS" which will greatly simplify the mounting problem of waste disposal and at the same time produce high protein food and industrial raw materials are suggested by research at the University of California.

Scientists on a sanitary engineering project have completed a laboratory study, with encouraging results, and are now building a pilot model pond for further tests.

The basic idea is to put sewage into an oxidation pond along with algae, single-celled aquatic plants. The algae grow well in such a media, and they produce oxygen which could be used to treat the sewage.

At the present time a large part of the cost of sewage treatment lies in the expensive pumps and other installations needed to supply oxygen.

The scientists have found that, within limits, the faster sewage is put through their experimental apparatus, the faster algae grow. The faster they grow the more oxygen they produce; and the more oxygen the faster the sewage is treated. Under controlled conditions they have converted sewage almost completely into algae in one day, in comparison to about 25 days for sewage processing in existing pond operations.

Algae, which contain up to 50% protein, are currently hailed as a promising source of food and industrial raw materials.

The Berkeley scientists feel that for psychological reasons sewage-grown algae would not ever be used for human consumption. Nevertheless, in the process of drying the algae, harmful bacteria would be largely eliminated. While the dried algae probably could be fed to cattle, chickens and hogs, the scientists say that inexpensive pasteurization should be applied as an added health measure.

With such a source of food for domestic animals, a great deal of the acreage now devoted to growing fodder could be used to produce food for human consumption.

Moreover, the algae crops could provide chemicals, fats, alcohol, oils for paints and varnishes, synthetic fibers, and basic materials for hormones and drugs.

The proposed sewage "farms" offer spectacular possibilities. The engineers say that 1,000 to 1,500 pounds of dry algae could be produced per million gallons of sewage per day. In the San Francisco Bay area alone some 200 to 250 million gallons of sewage are produced every day. Thus sewage "farms" could be an important source of raw materials.

Some 500 tons of algae could be grown in the same area as 30 tons of soybeans, which is probably the most productive agricultural crop known. Moreover, algae grow continuously and are harvested daily.

The method would get around one

of the big stumbling blocks encountered by other experiments in growing algae for food. In artificial cultures, nitrogen and other expensive nutrients must be added, which increase the cost beyond practical limits.

Such additions would not be needed in sewage "farms" because all growth elements are present in the sewage or richly provided by bacterial action in the sewage. These nutritional requirements are nitrogen, phosphorus, carbon dioxide, and minor nutrients.

Such "farms" would also conserve valuable nutrient elements now being poured into the sea in huge quantity. Algae, in growing, reclaim the nitro-

gen and other valuable elements which are otherwise irretrievably lost.

Finally, the method would help solve the mounting and increasingly expensive problem of disposing of man's waste. The engineers say the method would be simpler and less expensive than present treatment.

The investigation was originated by Harvey F. Ludwig, now an officer of the U. S. Public Health Service. William J. Oswald, research engineer, supervises the project under the faculty direction of Prof. Harold B. Gotaas, chairman of the division of civil engineering and irrigation in the University.

## *Heat Resistant Aluminum-Coated Steel*

► AN IMPROVED process of coating steel and other ferrous metals with aluminum developed by General Motors not only protects the base metals from rusting but also makes the coated product a heat-resistant material. Its use may conserve a number of strategic alloys now used in high temperature applications.

Developed by Alfred L. Boegehold and assistants in the General Motors Research Laboratories, the process is a simple, practical and inexpensive method for producing an aluminum base alloy coating over ferrous metals of high quality. Known as "Aldip," the process can be used to coat shaped articles or, in a continuous process, for coating sheet, wire or rod stock.

The process is now in pilot plant use in coating heat exchangers for an auxiliary tank motor. The heat exchanger consists of two small tanks connected by a series of parallel tubes

roughly similar to a miniature radiator. The exchangers may be in complex shapes.

In the process these heat exchangers are dipped in an alkaline cleaner, washed in hot water, run through an acid pickle, rinsed and dried in a furnace until ready for coating. Then they are dipped approximately four minutes in a bath of preheating salt at temperatures near 1,300 degrees Fahrenheit. Next they are transferred to an aluminum bath which is covered by a half-inch layer of salt flux. About 45 seconds later they are returned, while still red hot, to the preheat salt bath and slowly raised. Inside and out they assume a silvery appearance as the coating cools.

Microscopic examination of the coating on steel reveals an outer coat of aluminum-bearing iron. A second layer, next to the steel, is an iron-aluminum alloy.

## Chemical Process of Vision Duplicated Outside the Eye

# Sight by Light Sensitive Pigments

► YOU SEE because light bleaches light-sensitive pigments in the retina of your eye. The chemical changes that result are accompanied by electrical variations in the retina. Conveyed to the brain by the optic nerve, these electrical signals are there translated into visual images.

The chemical steps that make vision possible have been duplicated in the laboratory by Dr. George Wald, of the Biological Laboratory of Harvard University and were first described at Peoria, Ill., to the Bradley University Club of the Society of Sigma Xi, national society for the encouragement of scientific research. The lecture was repeated by Dr. Wald at various other colleges and universities throughout the country.

When you step out onto a sunny street, light bleaches the pigment in your eye and you become used to the brightness—less sensitive to light. This is light adaptation. Then step into a darkened movie theater. At first you can see nothing. But the chemical changes in your eyes are reversed by darkness and gradually your eyes become more sensitive to the faint light. The color of the pigment is restored. This is dark adaptation.

Two kinds of cells exist in your eye's retina, each with its own distinctive pigment. The cone cells, which operate in daylight, have the violet pigment called iodopsin. The other type of cells, the rods, by which you see in the dim illumination at night, have a red pigment, rhodopsin.

Only four chemicals were necessary for Dr. Wald to duplicate, in the laboratory, the process of light and dark adaptation. Important among the substances necessary to re-create both pigments is vitamin A; that is why night-blindness is one of the earliest symptoms of vitamin A deficiency.

But vitamin A exists in various forms, and not all forms will work in this visual cycle. The ordinary synthetic vitamin A will not do. The necessary form is that known to chemists as a cis-isomer. This form is present in liver oil.

In addition to vitamin A, the necessary chemicals for the rhodopsin cycle are: cozymase, alcohol dehydrogenase and opsin. Opson is the only one of these which must be obtained from the retina.

When light strikes the red rhodopsin, it is spontaneously bleached out into a yellow mixture of opsin and a carotenoid protein called retinene. The retinene, in the presence of the enzymes, alcohol dehydrogenase and cozymase, is converted into vitamin A.

In dark adaptation, vitamin A and opsin are changed back to rhodopsin. In the dark, and aided by the influx of additional vitamin A from the circulation and from certain cells of the eye, the opsin "traps" retinene, removing it to form rhodopsin. What happens, therefore, is that the vitamin A is re-converted to retinene by oxidation in the presence of the enzyme and then the retinene is condensed with opsin to form rhodopsin.

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## Materials, Processes and Machinery Among Latest Chemical Inventions

# Current Chemical Patents

Copies of complete specifications may be ordered from the Commissioner of Patents, U. S. Patent Office, Washington 25, D. C. Order by patent number and remit 25 cents for each patent, by money order or Patent Office coupon, not stamps.

### Titanium Alloys

► FIVE NEW titanium alloys, which promise to make this metal still stronger, are covered by patents assigned to the Remington Arms Company, Bridgeport, Conn., whose subsidiary, Rem-Cru Titanium, Inc., is the chief manufacturer of titanium and titanium alloy products. Pure titanium weighs about half as much as steel, yet is twice as strong as many steels. Although it weighs twice as much as aluminum it is three times as strong.

However, by making a proper titanium alloy, the strength of the metal can be doubled. Four of the patents have to do with adding specific materials to a titanium-aluminum alloy. The materials are antimony, bismuth, boron and indium. The patents claim in each case that addition of these materials results in a marked improvement in the properties of the titanium-aluminum alloy. These alloys, the inventors say, "show a rare combination of extraordinary strength with adequate ductility."

The fifth patent is for a quaternary alloy of titanium with aluminum, chromium and molybdenum. The presence of small amounts of carbon,

with or without nitrogen or oxygen, or both, it was found, may be beneficial and not interfere with the ductile strength of the metal.

The inventors are Robert I. Jaffee, Horace R. Ogden and Daniel J. Maykuth, Columbus, Ohio, and the patents are numbered 2,596,485 through 2,596,489.

### Taconite Pellets

► FOR AN IMPROVED step in the process of making pellets of taconite, or low-grade iron ore, Fred D. De Vaney, Hibbing, Minn., has received patent 2,596,132 and assigned it to the Erie Mining Company of Hibbing. As the nation's reserve of high-grade ore becomes low, economical methods of mining less productive ores become important.

For processing, taconite ores are shaped into pellets. During one step in the making, the pellets become extremely dry and tend to fall into dust, thus making it impractical to process them further.

Mr. De Vaney discovered that, by adding as little as one pound or as much as five pounds of starch or sodium silicate, the strength of the pellets is increased remarkably and they no longer tend to crumble as much.

### Cortisone Synthesis

► STEPS in the ultimate synthesis of cortisone made in Mexico have been patented and the patents assigned to the Syntex Corp. of Mexico City. A method of manufacturing this com-

pound from a kind of Mexican yams was recently announced.

The inventors are Stephen Kaufmann, George Rosenkranz and John Pataki, Mexico City, and they received patent numbers 2,596,562 and 2,596,563.

Both patents have to do with a process for preparing derivatives of a chemical called cyclopentanophenanthrene.

### Anti-Fungi Chemical

► A CHEMICAL compound claimed to be effective in the treatment of ring-worm and in the control of other fungi has been invented by Milton Silverman, Forest Hills, and Bernard Heinemann, De Witt, N. Y., and the patent, 2,596,107, assigned to Schiefelin and Co., New York. The compound is an agent selected from the class consisting of 3-carbalkoxy-4-hydroxy-benzocoumarin and 3-carbalkoxy-4-hydroxyhydrobenzocoumarin.

### Greater Uranium Yield

► A METHOD of substantially increasing the amount of uranium that can be extracted from bituminous shales containing only a small percentage of uranium has been invented.

The invention consists of two improvements upon older methods of extracting the uranium. First, the bituminous shale or shale culm is not burned before leaching and, second, the bituminous shale, after mixing with an alkali carbonate solution, is oxidized by air at a temperature slightly above room temperature.

The inventor also found that it is not necessary to grind the bituminous material into a fine powder when his

new method is used. The material is crushed, instead, to a grain size.

The inventor is Markus Larsson, Stockholm, Sweden, and he assigned his invention, patent number 2,597,504, to Frans Georg Liljenroth, Stockholm.

### Assaying Uranium Ore

► A METHOD of determining the abundance of isotopes in a number of uranium ore samples has been invented by Emilio G. Segre, Berkeley, Calif., and assigned to the Atomic Energy Commission.

His invention, patent 2,597,535, consists of a small lead house with four doors in it. On the inside of each door is an ionization chamber with an attached amplifier. The ore samples are placed in these chambers which are attached to radiation counters. A source of fast neutrons can be lowered from a lead safety room on top of the house down into the center of the house, where it is surrounded by a paraffine block. The block slows up the neutrons. Some of the resulting thermal neutrons are captured by the sample ores and fission products are formed. These activate the counters and from an analysis of the number of counts, a determination of the abundance of isotopes can be made.

### Better Tick Fever Tests

► A METHOD of preparing better antigens for tests to diagnose tick fever, scrub typhus, spotted fever and other diseases caused by viruses and rickettsia has been invented by Carl J. De Boer, Perth Amboy, N. J., and assigned to the American Cyanamid Company, New York. He received patent number 2,598,659.

In preparing the antigens from such tissues as are found in egg yolk sacs

it has been previously impossible to remove a substance which would react with the blood serum of a patient who has had syphilis but who does not necessarily have the disease to be tested for.

The inventor claims that it is now possible to extract this syphilis-reacting substance by using dichlorethylene as a solvent. It removed the syphilitic antigens without appreciable effect on the viral antigens.

### Sea Water Desalting

► AVIATORS downed in the ocean can get their drinking water from the sea around them much more easily through the use of an improved desalting briquet. The trouble with previous briquets, according to William Wood, Philadelphia, who is the inventor, was that it was very hard to get them to break up when put in the sea water to be desalinated.

Mr. Wood has assigned his patent, number 2,600,719, to the Permutit Company, New York.

Briquets are made by compressing the desalting agent—silver zeolite—together with other constituents under a pressure of up to 30 tons per square inch. Previously, a disruptor such as bentonite had been included to facilitate the breaking up of the briquet in the water.

However, the bentonite clogs the filter and serves no purpose in desalting the water. Mr. Wood has found that by using as a disruptor a silver cation exchange resin, the breaking up is facilitated, there is no clogging of the filter and the disruptor itself contributes to the desalting process.

### Curare's Active Constituent

► AN IMPROVED method of extracting from curare—the arrow poison—its active constituent, d-tubocurarine chloride, has been invented by Nickolas D. Jenesel, Dearborn, William R. Coleman, Grosse Pointe, and Harry M. Crooks, Jr., Detroit, Mich. Their patent, number 2,600,539, has been assigned to Parke, Davis and Co., Detroit.

The active constituent is useful in the treatment of spastic paralysis and as an adjunct to shock therapy in the treatment of certain medical disorders. But it has a low margin of safety. If too much is inadvertently used, it has a poisonous effect. Hence the necessity to extract it in substantially pure form.

The crux of the complicated process is the use of synthetic acid-absorbing resins containing free amino or imino groups. They are impregnated with a strong mineral acid before use.

### Frozen Orange Juice

► BETTER tasting and more "natural" frozen concentrated orange juice results from an invention which received patent number 2,588,337. George Sperti, Cincinnati, is the inventor and he has assigned his patent to the Institutum Divi Thomae Foundation, a non-profit corporation of Cincinnati.

The fresh juice, according to the patent, is first concentrated by freezing. The ice is then separated from the concentrate.

The ice is then thawed and evaporated and the soluble solids, including pulp and sugars, are recovered and put back with the concentrate.

## Proudly Presented

- X-RAY DIFFRACTION and Geiger counter X-ray spectrometric equipment is described in a catalogue issued by the Research and Control Instruments Division, North American Philips Company, Inc., 750 South Fulton Avenue, Mount Vernon, N.Y. The electron microscope is also included.
- As PART of the educational campaign being conducted by the Manufacturing Chemists' Association, a pamphlet, "Chemicals and the Food You Eat," has been issued. One section is devoted to a description of how chemicals for food use are developed.
- "FACTS AND FIGURES for the Chemical Process Industries" has appeared in a third edition published by the American Chemical Society's journal, Industrial and Engineering Chemistry. It contains a wide variety of statistical information and interpretative articles on various fields. America's chemical industry has grown at the rate of 10% a year for the past quarter of a century. In 1952 it is having its greatest plant expansion, with a capital outlay of almost \$1,500,000,000.
- SODIUM and potassium salts of rosins and resins are used in soluble oils and alkaline cleaners. A new technical booklet issued by Hercules Powder Company, Wilmington, Del., describes properties and applications of these Dresinate materials which are available in dry, liquid and paste forms.
- THE FOLINIC acid group among growth factors is described in detail in an Eli Lilly and Company, Indianapolis 6, Indiana, publication.
- A REVOLUTIONARY method for observing the appearance and behavior of textile fibers and the dye bath during the continuous and complete dyeing cycle is described in "Microscopic Dyeing Phenomena Studies with the Microdyoscope" by H. E. Millson and L. H. Turl, Application Research Laboratories, American Cyanamid Company, Calco Chemical Division, Bound Brook, N.J.
- PROCESS instrumentation was featured in the May 1952 issue of Chemical Engineering, 330 West 42nd Street, New York 36, N.Y., and a detailed chart and descriptive sheet entitled "Chemical Engineering Guide to Process Instrument Elements" was compiled.
- OXYGEN production is described in a booklet issued by Blaw-Knox Company, Chemical Plants Division, P.O. Box 778, Pittsburgh 30, Pa. This describes oxygen and other low temperature separation processes as developed by Gesellschaft fuer Linde's Eismaschinen A.G.
- INDUSTRIAL magnifiers are explained in a publication by Bausch and Lomb Optical Company, Rochester, N.Y., which describes 75 different sorts.
- THE PREPARATION and use of lithium stearate in the making of grease is described in a report by Witco Chemical Company, 295 Madison Avenue, New York 17, N.Y.
- SCIENTIFIC glassware that cannot be ordered from a catalog is made to order, following sketches submitted to the glassblowers. This service is described in a publication by Wakefield Industries, Inc., 5108 West Grove Street, Skokie (Chicago), Ill.

## Book Condensations

► Recorded in the pages of books are data and information that has had time to be arranged and summarized, the textual material which the student learns, the occasional biographical opus which gives science personality, and the gatherings together that some author and publisher believes will sell and perhaps be useful. *CHEMISTRY* keeps you current with books through this listing.

BIOCHEMISTRY AND HUMAN METABOLISM—Burnham S. Walker and others—*Williams and Wilkins*, 812 p., illus., \$9.00. Intended as a text for medical students, this work emphasizes human biochemistry. Clinical applications are combined with theoretical material.

CHEMICAL PHYSIOLOGY OF ENDOPARASITIC ANIMALS—Theodor von Brand—*Academic Press*, 339 p., \$7.50. Bringing together and reviewing literature having to do with the complicated life cycle of parasites, their pathological effect on the host and other similar topics.

FOOD SCIENCE: A Symposium on Quality and Preservation of Foods—E. C. Bate-Smith and T. N. Morris, Eds.—*Cambridge University Press*, 319 p., illus., \$8.00. A collection of lectures given at the University of Cambridge and revised for publication. Contains chapters on the chemical mechanisms of spoilage and methods of food preservation.

MATERIALS SURVEY—U. S. Bureau of MINES—*Govt. Printing Office*, illus., paper. Antimony, 280 p., \$1.25; Lead, 574 p., \$3.50; Asbestos, 146 p., \$1.75;

Nickel, 291 p., \$2.00. This survey of critical materials was compiled for the Materials Office, National Security Resources Board, to show what the emergency supply and demand is in the U. S.

PROPERTIES OF THE PRINCIPAL FATS, FATTY OILS, WAXES, FATTY ACIDS AND THEIR SALTS—M. P. Doss—*Texas Company*, 244 p., \$5.00. Tabulating the properties of a host of materials in this field and listing more than 1,350 literature references.

SEaweeds AND THEIR USES—V. J. Chapman—*Pitman*, 287 p., illus., \$6.00. The author believes that one primary reason for the failure of seaweed industries is their concentration on one aspect only, such as the production of iodine or cattle feed.

## BOOKS

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